IFRF

Annual Report 2011 to members

INTERNATIONAL FLAME RESEARCH FOUNDATION

IFRF Doc N° K63/y/11
Livorno, June 2012

Annual Report 2011
Summary Financial Statements 2011

CONTENTS

2011 HIGHLIGHTS

Technical

- Research activity on flame characterisation continues on replica IFRF No 1 furnace: gas and coal in oxy-fuel combustion
- Isothermal Plug Flow Reactor produces characterisation results on different coals
- New measurement probes and instruments developed
- On line Solid Fuel Database expands
- 5 technical reports issued

Management and organisation

- Ongoing project to determine long term business strategy for IFRF
- 1 TOTeM held
- 1 Technical Workshop organised
- 1 Technical Course organised
- Two bids won for places in EU Projects

2011 HIGHLIGHTS

Membership

The IFRF Membership base is organised around eight National Committees and the Associated Membership Group, which caters for countries not within reach of a National Committee.

During 2011, Member numbers remained relatively stable at around 130 industrial and academic organisations across Europe, the Americas, Australia and China, representing some 1500 individuals.

As part of the IFRF Strategy Redefinition exercise, a plan to extend IFRF Membership directly to individuals was proposed at the 2011 meeting of the Joint Committee and will be implemented during 2012.

GENERAL SECRETARY'S STATEMENT

An apt one sentence summary of the IFRF's last year might be "Consolidation with an eye to the future, despite the severe financial crisis in Europe".

I believe that 2011 was an important year for the foundation, apart from the sad loss of our former President Richard Waibel. Leo and his staff returned the pilot plants at the Livorno test facility to full operation and used them optimally to obtain comprehensive data. The staff complement was enhanced, both numerically and in terms of experience, exploiting the possibilities offered by the agreement with the University of Pisa. These achievements created the necessary conditions to raise our heads above purely operational issues and look ahead, not only to consolidation, but also to the redefinition of our strategy.

As indicated by the IFRF President, the goal of our deliberations was a strategy to meet Members' networking and information requirements. Those deliberations took place in the context of a worldwide revolution in the energy field.

The reality is that aided by rich supplies of carbon and shale gas, the rate of uptake of renewables in the developed world is matched by the uptake rate of combustible fuels in the developing world. Whilst the potential research area in Europe is the flexibility of conventional fossil fuels, in America the focus is on the use of shale gas as a replacement for coal. In both realities, pollution reduction remains paramount.

These are the key factors which informed our strategy. We have a responsibility to continue to open new research horizons. At the same time, the challenge now is to transfer our established knowledge of conventional combustion processes to countries just starting out on this journey. In the latter regard, as I write, we are preparing coal tests for a Russian client. China and India also suggest themselves as markets for our expertise.

Finally we have also borne in mind two other fundamental areas which are targets for emissions regulations and in which the IFRF has solid know how: glass and steel.

The IFRF currently has the resources to meet the challenges it faces. As the Head of Enel Research I confirm Enel's commitment to support the Foundation's activities and promote them in the 40 countries in which we have a presence.

Sauro Pasini
General Secretary, IFRF

PRESIDENT'S STATEMENT

My first thought in considering 2011 is of the sad loss of former IFRF President Richard (Dick) T. Waibel. I personally worked with Dick from 1991 and he was a trusted friend - and of course a strong supporter of and contributor to the IFRF, both through his many years as AFRC Chairman, and then as Vice-President and President of the IFRF. Dick's untimely passing represented a great loss to the IFRF and more broadly to the Combustion community.

Dick would no doubt have been pleased to know that in 2011 the IFRF was granted Partner status in two important European research programs, BRISK and RELCOM. These projects are referred to elsewhere in this document and they will each provide some 500 k€ over their four year lifetimes, also bringing significant benefit to our Members.

In the case of BRISK specifically, these benefits include joint research and networking activities through a transnational access mechanism which enables outside organizations to access a large number of facilities across Europe.

Early in 2011, under the recommendation of former General Secretary Gennaro de Michele, we initiated a survey amongst our Members in order to redefine our long term Strategy. Networking was rated as one of the most important benefits of IFRF Membership, alongside access to information and participation in research. The main conclusion of the strategy review was that the IFRF should further develop and improve its networking tools and opportunities. Consequent actions will be rolled out in the short to medium term. These will include redesigning the IFRF website and expanding the membership structure by allowing access to independent professionals, students and retirees.

Since its creation in 1948, the IFRF's vision is to be the international reference point for clean and efficient industrial combustion. Strategically, the Foundation aims to develop its Membership, attract new business and reposition itself in the minds of the wide community of industrial combustion engineers, researchers and young graduates.

Our affection for our existing Members and our gratitude for their support remain unchanged. We look forward to moving ahead together.

Jacques Dugué
President, IFRF

TECHNICAL ACTIVITIES

Technical Reports and Papers

Five reports were published during 2011 and are available for download by Members at *http://www.research.ifrf.net/research/new.html*

F 73/y/02 - Application of an optical diagnostic methodology to the characterisation of solid fuel combustion in the isothermal plug flow reactor operating in conventional and oxy-fuel conditions *S. Tarquini, C. Galletti, G. Coraggio, M. Faleni, L. Biasci, R. Bruschi, F. Di Carlo, E. Giacomazzi, S. Giammartini,* *December 2011*

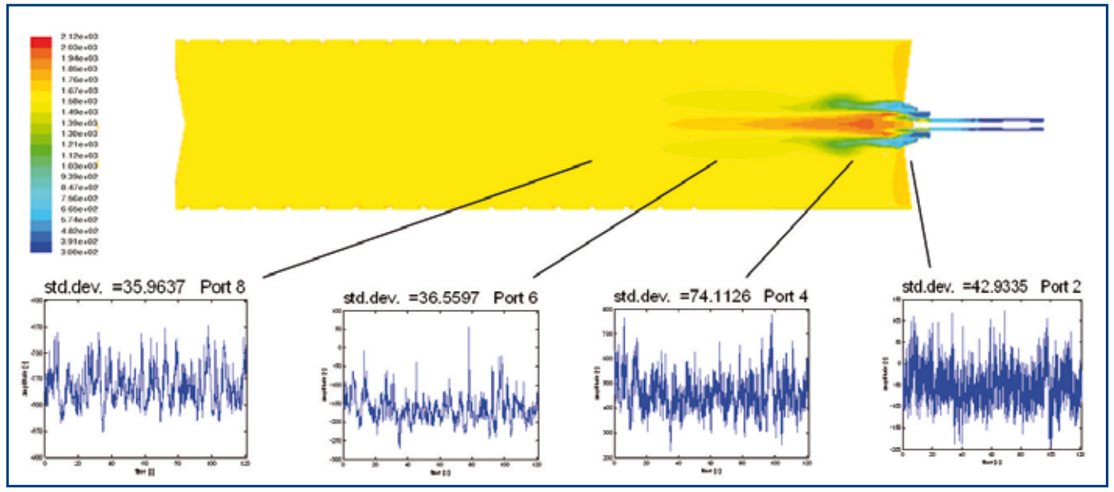
Optical probes developed by the Electric System Research Division of ENEA (Italian Agency for Energy and Environment) and useful in combustion diagnostics, had been tested with good results in homogeneous (natural gas oxidation) combustion processes. To test heterogeneous combustion (pulverized coal oxidation), ENEA, IFRF and the University of Pisa cooperated in experimental campaigns using the **IPFR**. This facility was chosen because of its very high heating rate, similar to real industrial boilers.

This report provides a detailed description of the experimental equipment used for tests and of the conditions tested. In addition the procedures adopted for data analysis and the experimental results are presented and discussed.

F 73/y/03 - Optical Diagnostics in a 3 MW furnace Oxy-RFG-coal/gas combustion tests *L. Lupetti, C. Galletti, G. Coraggio, L. Tognotti, R. Bruschi, E. Giacomazzi, S. Giammartini,* *December 2011*

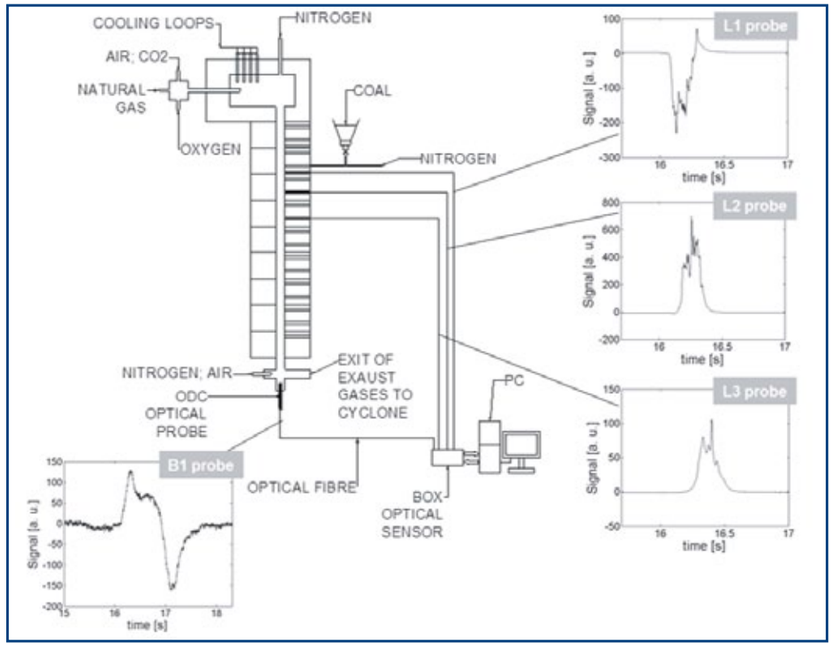
This report documents further collaborative tests on the ENEA optical probes, this time on the IFRF's **Fo.Sper** 3 MW furnace. A detailed analysis of the signals is also provided and conclusions drawn on the applicability of the diagnostic technique to industrial combustion systems.

• *ODC signal comparison with models*

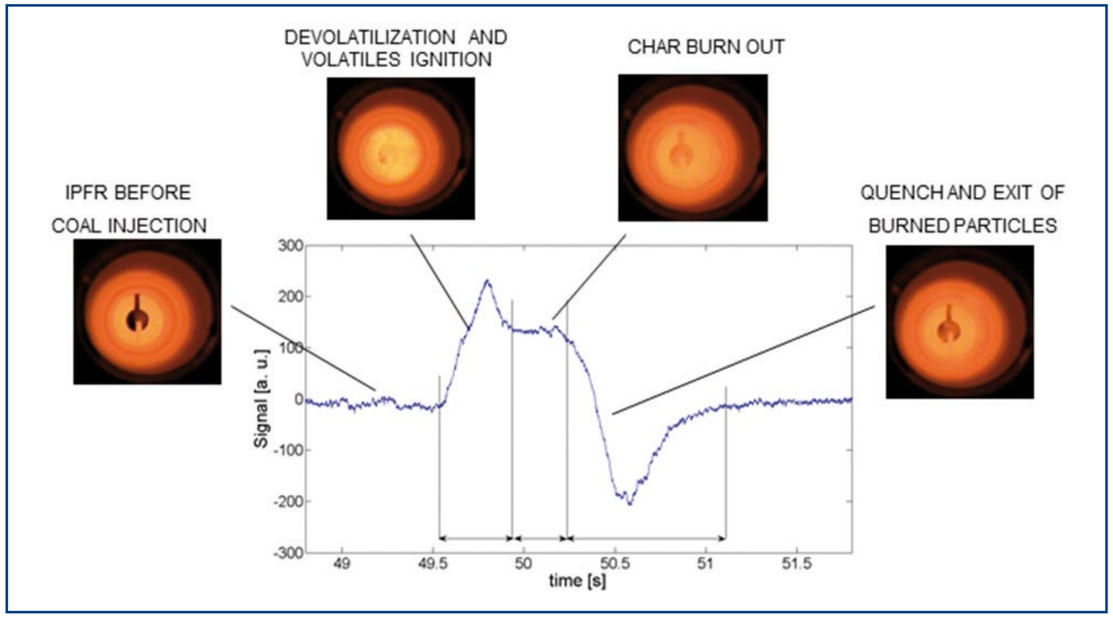


TECHNICAL ACTIVITIES

• *Scheme of IPFR, arrangement and signals from ODC probes*



• *ODC IPFR*



TECHNICAL ACTIVITIES

G 25/y/01 - Verification, validation and uncertainties quantification in industrial combustion modelling: some practical tools

A. *Parente, C. Galletti, G. Coraggio, L. Tognotti,* *May 2011*

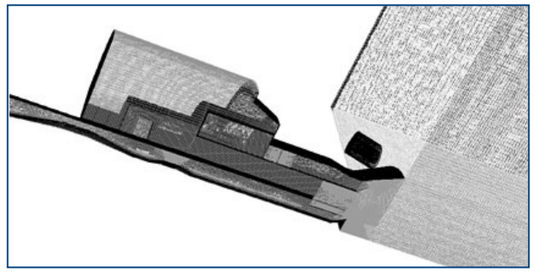
The report proposes a methodology for estimating the uncertainty in experiments and numerical simulations, to promote a constructive validation of computational approaches. Then validation hierarchies are described for both flameless and oxy-fired applications

Two guiding examples, a self-recuperative flameless unit and **Fo.Sper** are identified to show the main steps involved in the V&V methodology. The consistency between numerical models and experimental data is then discussed to demonstrate the potential of the methodology to identify which values of the uncertain input parameters allow the definition of a consistent predictive model.

G 25/y/02 - Modelling oxy-combustion tests on Fosper: comparing different Validation approaches *C. Galletti, G. Coraggio, L. Tognotti,* *December 2011*

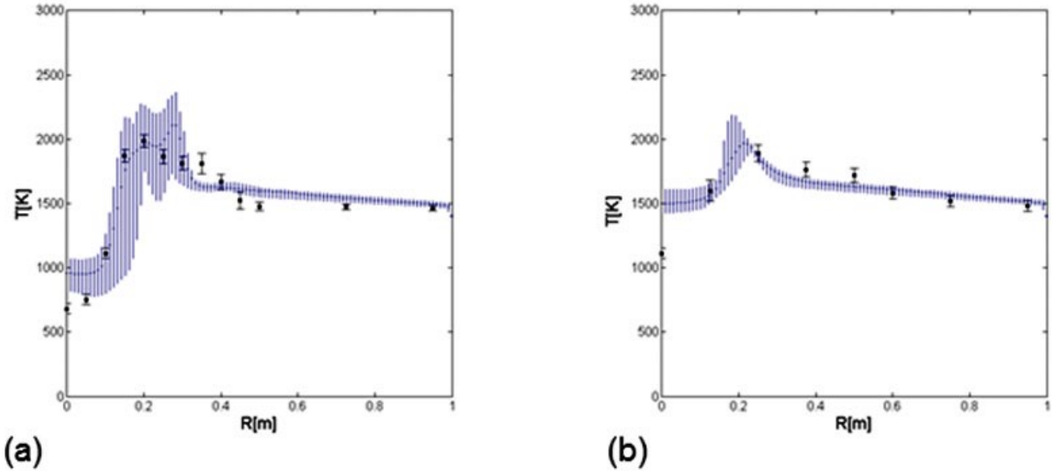
On the basis that gas-fired oxy-fuel conditions may help shedding light into some modelling aspects, CFD simulations are performed of experiments conducted with a 3 MW low-NOx burner installed in the **Fo.Sper** furnace in oxy-fired conditions fed with both NG and coal. The concept is based on the proper Design of Experiment (DoE) required for developing a joint experimental and modeling activity.

• *Modeling*



TECHNICAL ACTIVITIES

• *Modeling and validation*



F 39/y/01 - Inorganic aerosol formation tests in the Isothermal Plug Flow Reactor

L. Biasci, M. Falcitelli, G. Coraggio, M. Faleni, *December 2011*

IFRF, ENEL and CPR undertook a joint project to develop a suitable system and the related procedures for studying aerosol formation in co-combustion of coal and biomass.

The report describes the experimental facilities and the procedure used. To produce and sample aerosol particles, the IPFR was modified to recreate the conditions typical of the convective section of an industrial plant.

• *Aerosol Chimney*

INTERNATIONAL TECHNICAL EVENTS

Computational Fluid Dynamics Validation Workshop

Another in the series of IFRF CFD Workshops took place at Åbo Akademi in Turku, Finland in June.

Following on from previous workshops on the topic - **Doosan Babcock, Scotland** in 2010, **IFRF 16th Member Conference**, **Boston**, 2009, and the inaugural workshop in **Munich** in 2008, the meeting allowed Member organisations to describe their current CFD Validation activities based on the use of IFRF and other combustion data sets.

Presentations from all the CFD Workshops are downloadable from the IFRF website at *http://www.trends.ifrf.net/trends/projects.html*

IFRF Technical Course

In March 2011 IFRF organised a one week technical course entitled **Clean Industrial Fuel Utilization** which was held in Gliwice Poland at the Silesian University of Technology. Coordinated by Professor Klaus Hein, the course was well received, attracting 30 delegates from industrial companies and academic institutes across Europe, and a member organisation from Canada. Speakers included academics from the Silesian University of Technology alongside well known IFRF figures such as ENEL's Sauro Pasini, Professor Lars Stromberg and Professor Roman Weber.

The course also featured a site visit to the 460 MWe LAGISZA POWER PLANT, the world's largest supercritical Circulating Fluidized Bed Boiler.

Thanks and acknowledgements to course delegate Ida Mann for the photos below.

INTERNATIONAL TECHNICAL EVENTS

TOTeM 37

In September 2011 the IFRF returned to Poland, this time to Technical University of Wroclaw, where **TOTeM 37, "Innovative and advanced co-firing technologies"** was organised as a dissemination activity for **DEBCO**, an EU FP 7 project in which the IFRF has been involved since 2008.

The event was attended by upwards of 30 delegates including representatives of another FP7 EU funded project RECOMBIO, (Recovered Fuels combined with Biomass) which has similar objectives, being concerned with the efficient co-utilisation of low quality biomasses and Solid Recovered Fuels produced from municipal solid waste. The meeting conclusions, written by IFRF Superintendent of Research Neil Fricker, are included in the material available for download on both the **DEBCO** website, which IFRF established and manages at *http://debco.eu* and on the IFRF website at *http://www.trends.ifrf.net/trends/projects.html*

RESEARCH ACTIVITIES

Background

Areas of focus during 2011 continued to be those defined in IFRF Doc. No. D 0/y/37: **IFRF Members Research Programme, An Agenda for 2010-2014**.

- **Solid fuel characterisation/focus on biofuels**
- **Probe development for oxy-combustion/novel combustion technologies**
- **CFD validation: tests and sub-models**

As before, IFRF needed to augment the financial resources provided by Membership fees, either through external funding or by seeking in-kind support. These initiatives also made possible some desk reviews in the areas of Oxy-fuel combustion, Solid fuel characterisation and Measuring techniques.

IFRF would like to thank the private sponsors and partners not only for supporting the activities, but also for agreeing to share the non-proprietary aspects of this work with the IFRF Members. This group includes ENEL, ENEA, University of Pisa, EdF, Åbo Akademi, as well as the European Commission through the DEBCO and Friendly Coal projects, and, as of the end of 2011, the **RELCOM** and **BRISK** projects.

Research Areas

1. Semi–industrial tests

Access to the ENEL Livorno research facilities as well as to those of the University of Pisa at S. Piero enables IFRF to undertake experimental work on semi-industrial and pilot-scale furnaces and reactors.

This work is the principal focus of the research team and is described by topic below.

OXY-COMBUSTION STUDIES

The work to establish an oxy-coal or oxy-natural gas capability on **Fo.Sper** was completed in 2011. In addition to new oxygen, RFG and coal supply systems, the furnace is now fitted with sealed access ports that are vitally important to reducing air ingress when operating under oxy-combustion conditions. **Fo.Sper** is now one of the few experimental rigs allowing access to Oxy/RFG/Coal and Oxy/RFG/Gas flames at a pilot scale of 2 to 3 MW.

During 2011, **Fo.Sper** was used to run oxy-combustion tests for ENEL and other companies and produced four weeks of campaigns at 3 MWth with oxy-gas and oxy-coal. The tests also covered new ground, contributing practical experience on firing solid fuels in oxy/Recycled Flue Gas (RFG) atmospheres, firstly to collect deposits for corrosion studies within an OXY/RFG/Coal flame – part of the EC co-funded OXYCORR2 project.

For the EC co-funded **RELCOM** project which kicked off very late in 2011, work began on the task of providing a baseline for oxy-coal burner scale-up criteria starting with documenting the characteristics of the IFRF's **AASB** burner. Further tasks will be to characterize three coals in oxy combustion environment with the **IPFR** (Isothermal Plug Flow Reactor), and develop and validate sub-models. A 3 MW campaign is planned for the last months of 2012.

RELCOM – "Reliable and Efficient Combustion of Oxygen/Coal/Recycled Flue Gas Mixtures" is funded by the European Commission Seventh Framework Programme and involves a consortium of higher education institutions, research centres and industrial partners bringing together the best in research facilities and technology development expertise.

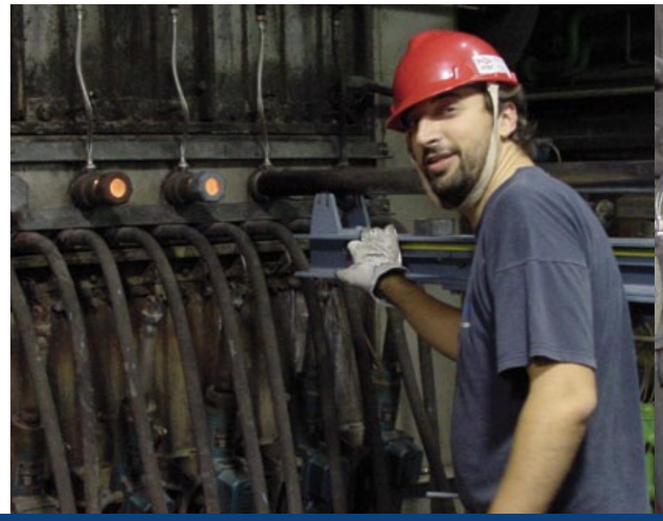
The coordinator is IFRF Member Glamorgan University.
http://www.relcomeu.com

RelCO2m
Reliable Combustion

THERMOCHEMICAL CONVERSION OF 2ND GENERATION BIOFUELS

For the EC co-funded **BRISK** project which also began late in 2011 and is concerned with the development of a European research infrastructure for thermochemical biomass conversion, a 200 kW downdraft fixed bed gasifier and a tar cracking reactor unit were added to the list of experimental facilities available to IFRF.

In terms of the Transnational Access Initiative which is a feature of **BRISK**, these facilities may be used by researchers outside the project partnership.



RESEARCH ACTIVITIES

The paper **Pilot scale biomass gasification at CRIBE: survey of the experimental activities** *M. Simone, F. Barontini, C. Nicolella, E. Biagini, L. Tognotti,* presented at the IFRF 17th Member Conference in Paris in June 2012, describes these two facilities and provides a novel set of pilot scale experimental data

BRISK - "Research Infrastructure for Sharing Knowledge" is a new four year initiative from the European Commission's 7th Framework Programme (FP7). Coordinated by IFRF Member KTH Royal Institute of Technology in Sweden, **BRISK** involves 25 European organizations in three principle activities: Joint Research, Networking and Transnational Access. In terms of the latter, some 47 laboratory facilities are offered.
http://www.briskeu.com

500 KW FURNACE

In 2011 IFRF worked together with ENEL on the revamping of the ENEL 500 kW furnace. After the completion of this phase this rig is again fully operational and in line with the new safety regulations. In 2012 coal-torrefied biomass co-combustion tests will take place with special emphasis on fouling behavior of increased biomass shares. (IFRF Doc. No. C36/y/01 500 kW Furnace - Characteristics and operations, M. Faleni).

2. Development of new instrumentation and methodologies

In the period under review, IFRF continued to re-establish its **probe manufacture** capacity with a focus on adapting them to new combustion concepts, in particular oxy-combustion. **IFRF probes** now available for purchase include suction pyrometers and heat-flux meters.

Regarding **optical diagnostics**, IFRF worked with ENEA to test their ODC (Optical Diagnostic in Combustion) system. ODC is based on the principle of the analysis of the spectrum of turbulent flame radiative emission collected by means of a photo-diode device. Radiative emission of a flame is due to a chemiluminescence effect and to thermal emission of a gray/black body. Spectra show a decaying trend towards high frequencies and instabilities are easily detected.

ODC tests on **Fo.Sper** during oxy-coal campaigns demonstrated the system's ability to monitor the existence of different combustion regimes and transitions between them,

RESEARCH ACTIVITIES

and to capture, even in semi-quantitative terms, important characteristics of the emission related to the flow field and the temperature profile in the furnace. Thus the existence of frequencies typical for all operating conditions was highlighted.

The ODC optical technique was also applied at the **IPFR (Isothermal Plug Flow Reactor)** to obtain information on the combustion of solid fuel particle streams. The optical probes were found able to capture the passage of coal streams and to identify different phenomena (e.g. volatiles ignition and char oxidation).

The spatial arrangement of the probes was studied in order to derive quantitative information (such as particle velocity, ignition delay and devolatilization time) from the correlation of four single signals.

These results are of great interest. The derivation of heterogeneous and homogeneous kinetics in O_2/CO_2 atmosphere is acknowledged to be one of the main research needs for the development of oxy-combustion technology.

IFRF probes currently available; Three sizes of IFRF external pyrometer shields: the bigger one is used for FOSPER and 500 kW furnace measurements; the middle one is used in the IPFR and the smaller one will be used in TAO.

RESEARCH ACTIVITIES

3. Solid fuel characterisation and development of a solid fuel database

http://sfdb.ifrf.net

The **IFRF Solid Fuel Database** was published online at the end of 2010 and is available to IFRF Members to use in the design and operation of industrial solid fuel fired combustors and gasifiers. Originally populated with devolatilization, char combustion and nitrogen release data from the **IPFR (Isothermal Plug Flow Reactor)**, the key facility for solid fuel characterisation, the database is being steadily extended with information generated at the same source.

The **IPFR** was rebuilt and re-commissioned in 2010, and upgraded to simulate **oxy/solid fuel** conditions. The facility is now also fully operational for investigating the formation and fate of aerosols when firing coal and biomass blends in the presence of sulphur oxides, having been equipped with a special chimney to reproduce temperature-time histories in fouling region and with an ELPI Dekati for aerosol quantitative assessment. (See report IFRF Doc. No. **F39/y/01**: *Inorganic aerosol formation tests in the Isothermal Plug Flow Reactor.)*

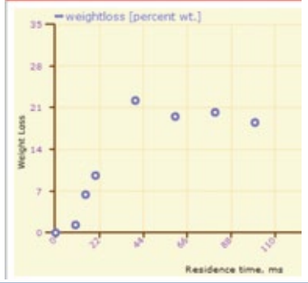
Further development of the Solid Fuel Database will result from activities within the **RELCOM** and **BRISK** projects, particularly as regards information on coal and biomass combustion characteristics with different atmospheres (e.g. O_2/N_2, O_2/CO_2).

Furthermore, through the **BRISK** Transnational Access mechanism, the IPFR will be available for experimental use by external organisations. Please refer to the **BRISK** website for details. *http://www.briskeu.com*

Experiment description	
Fuel:	Walsum sample 2
Facility:	IPFR 1994-2006
Procedure:	Devolatilisation
Experiment conditions:	View conditions
Reference paper:	View reference paper
Notes:	

Recorded data	
Residence time, ms	Weight Loss
0	0.0
10	1.3
15	6.4
20	9.6
40	22.2
60	19.5
80	20.2
100	18.5

Data plot



Experiment conditions and results in the SFDB (example)

RESEARCH ACTIVITIES

4. Validation of combustion modelling for practical combustion systems

The focus of the experimental work on Livorno pilot scale furnaces is also the development of criteria for validating industrial combustion CFD models and codes. Test runs are executed not only to create new data sets on new fuels/technologies, but also to fill gaps in data for numerical model validation and to quantify experimental uncertainties.

In the year under review, IFRF continued to contribute to the body of knowledge in this area, coordinating a further workshop in its CFD series, at Åbo Akademi in Turku, Finland in June, and organising **TOTeM 37** in Wroclaw.

Presentations made by IFRF researchers at Turku workshop and **TOTeM 37** included:

Estimation of Confidence in Experimental Data for Model Validation *A. Parente, C. Galletti, G. Coraggio, L. Tognotti*

Validation of oxy-fuel combustion modelling via semi-industrial furnace tests
C. Galletti, A. Modesti, S. Pelagallo, L. Tognotti

Characterisation needs for modelling solid fuel combustion in industrial systems
L. Tognotti

Strategies and approaches for modeling full scale biomass co-firing *L. Tognotti, B. Risio*

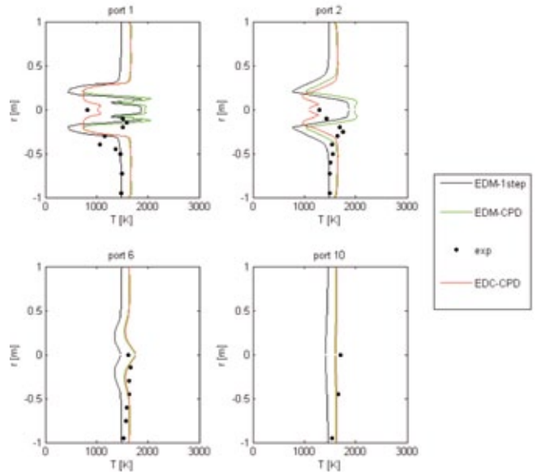
The proceedings of the CFD Workshop and **TOTeM 37** are accessible by Members at *http://www.trends.ifrf.net/trends/projects.html*

On this topic the following papers were prepared for presentation at the **IFRF 17th International Member Conference**:

Modelling oxy-coal combustion in a semi-industrial furnace *C. Galletti, L. Giovannini, G. Coraggio, L. Tognotti*

Optimal choice of variables for the identification of chemical time-scales with detailed kinetic schemes *B. J. Isaac, C. Galletti, A. Parente, J. Thornock, L. Tognotti, P. J. Smith*

Example of comparison between experimental temperature and that predicted with different combustion and devolatilization models: FOSPER furnace at port 1(z = 0.17 m), port 2 (z = 0.46 m) port 6 (z = 1.04 m) and port 10 (z = 1.62 m). 3 MW oxy-coal runs.



MANAGEMENT AND ORGANISATION

Staffing

During 2011, the staff complement of the IFRF has again been sustained by contracted Investigators and a technician. During the year, the group working in the IFRF building on the premises of ENEL Ricerca in Livorno Italy comprised:

- **Leo Tognotti**
  Director
- **Tracey Biller**
  Communications and administration – permanent staff
- **Giovanni Coraggio**
  Investigator, Measurement Techniques - permanent staff
- **Leonardo Biasci, Massimo Pampaloni**
  Post Doctoral students, IPFR tests - contractors
- **Beatrice Cioni**
  BRISK – part time contract
- **Marco Faleni**
  IPFR Technician - contractor
- **Jarek Hercog**
  located at IEN, Poland - consultant
- **Neil Fricker**
  Consultant

ENEL and UNIPI support for Research

University of Pisa: Researchers Enrico Biagini, Chiara Galletti and Marco Simone

ENEL Experimental Area: Davide Cecchini and a team of 10 engineers and technicians provide the technical support to run the facilities and for the development of probes and instrumentation.

External contractors which provided other support services for IFRF during 2011 were:

- **Studio Bonaccorsi** - *bookkeeping and accounts*
- **Studio Guerrini Vitti** - *auditors*
- **Tesene**, **Nextworks and InterVisors** - *IT*
- **Patrick Lavery** - *editing and website insertions*

In-kind support was also made available by IFRF Member Canmet to edit the IFRF Journal

- **Pat Hughes** (Canmet), *Editor-in-Chief*
- **Peter Gogolek** (Canmet), *Editorial Secretary*

IFRF Doc N° K63/y/11
Livorno, June 2012

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MANAGEMENT AND ORGANISATION

Strategy Project

The IFRF Strategy Redefinition exercise which commenced late in 2010 made good progress during 2011.

On the basis of the outcomes from the Member Survey performed during February and March, the Joint Committee held a two day strategy workshop during their annual meeting in Turku in June.

Working with a professional facilitator, the group considered member perceptions of the services offered by the IFRF and the benefits received, and then evaluated the options available to enhance these so as to ensure the organisation's continued relevance, stability and growth.

Having agreed on the key elements to be included in a formal strategy plan which would set a medium term direction for the organisation, the Joint Committee tasked an IFRF staffer with creating the document and presenting it to the IFRF Executive later in the year.

Actions to be included in the plan were:

- Formulation of business objectives
- Refinement of the IFRF Vision and Mission Statements
- Comprehensive redesign of ifrf.net
- Recommendations for a new membership structure

The plan was delivered in November along with a proposal regarding the IFRF website. Refined versions of these documents, as well as a set of recommendations around opening IFRF Membership to individuals are to be presented to the Joint Committee at their 2012 meeting in Paris, the venue for the IFRF 17th International Member Conference. It is expected that implementation of the proposals selected will begin swiftly.

EXECUTIVE

IFRF EXECUTIVE COMMITTEE

The IFRF was registered in Italy as a not for profit foundation in 2006, following its move from IJmuiden, the Netherlands. In terms of the statute established in that year, the governing body of the IFRF is vested in a Council called "Joint Committee", which numbers representatives of each of the National Committees as well as individuals from various elective areas of combustion research.

The Joint Committee appoints the IFRF Director and also the Executive Committee which supervises and advises the execution of the tasks of the Director.

At December 31st 2011, the Executive Committee of the IFRF comprised:

President:
Jacques Dugué
Total, *France*
(January 2011 to December 2013)

Vice President:
Hartmut Spliethoff
TUM, *Germany*
(January 2011 to December 2013)

General Secretary:
Sauro Pasini
Enel Engineering & Research, *Italy*
(June 2009 - No fixed term)

Superintendent of Research:
Neil Fricker
University of Glamorgan, *UK*
(January 2011 to December 2013)

Joint Committee Representative:
Chuck Benson
ETA Partners, *USA*
(June 2011 to December 2013)

FINANCIAL

FINANCIAL SUMMARY

Financial Summary

The IFRF has been registered in Italy as an ONLUS (Organizzazione Non lucrativa di Utilità) since 2008. During the financial year 2011 this status was maintained.

The Financial Statements are presented in the form of a **Balance Sheet** and Income Statement showing the financial information for ONLUS. The consolidated Profit and Loss figure is compared with the approved 2011 budget.

The figures used in this annual report are taken from the full audited Financial Statements for ONLUS produced according to Italian bookkeeping and accounting principles. Copies of the full Financial Statements were made available to Members of the IFRF's governing body, the Joint Committee following the acceptance of a draft version by the IFRF Executive Committee.

The Financial Statements were accepted by the IFRF Executive Committee as being a true representation of the financial affairs of the International Flame Research Foundation in 2011.

FINANCIAL

BALANCE SHEET AT 31st DECEMBER 2011 – ONLUS

ASSETS		At 31-12-2011		At 31-12-2010
		Partial	Total	
B	FIXED ASSETS			
B.I.	*INTANGIBLE ASSETS*			
B.I.1	Set up and expansion costs			
B.I.4	Concessions, licenses, trademarks and similar		1.388 €	2.370 €
Total INTANGIBLE ASSETS			1.388 €	2.370 €
B.II	*TANGIBLE ASSETS*			
B.II.3	Equipment and machinery		127.801 €	152.537 €
B.II.4	Other assets		5.519 €	9.097 €
B.II.5	Assets under construction and part payments			
Total TANGIBLE ASSETS			**133.320 €**	**161.634 €**
TOTAL FIXED ASSETS			**134.708 €**	**164.004 €**
C	CURRENT ASSETS			
C.I	*INVENTORY*			
C.I.3	Contracted work in progress		177.140 €	163.382 €
Total INVENTORY			**177.140 €**	**163.382 €**
C.II	*RECEIVABLES*			
C.II.1	Trade receivables		204.004 €	189.750 €
	within 12 months	204.004 €		189.750 €
C.II.4-bis	Tax credit		8 €	47.606 €
	within 12 months	8 €		47.606 €
C.II.5	Other Receivables		47.061 €	7.149 €
	within 12 months	47.061 €		7.149 €
Total RECEIVABLES			**251.073 €**	**244.506 €**
C.IV	CASH AND BANKS			
C.IV.1	Bank and postal deposits		327.411 €	56.757 €
C.IV.3	Cash		257 €	50 €
Total CASH AND BANKS			**327.668 €**	**56.807 €**
TOTAL CURRENT ASSETS			**755.881 €**	**465.145 €**
TOTAL ASSETS			**890.589 €**	**629.149 €**

FINANCIAL

BALANCE SHEET AT 31st DECEMBER 2011 – ONLUS

LIABILITIES		At 31-12-2011		At 31-12-2010
		Partial	Total	
A	EQUITY			
A.I.	*CAPITAL*		171.785 €	171.785 €
A.V	Statutory reserves		146.853 €	188.701 €
A.IX	Profit (loss) for the period		41.326 €	-41.848 €
Total EQUITY			**359.964 €**	**318.638 €**
B	*PROVISION FOR LIABILITIES AND CHARGES*			
B 2	Deferred taxes		—	—
Total PROVISION FOR LIABILITIES AND CHARGES			—	—
C	*EMPLOYEE RETIREMENT INDEMNITY*		27.558 €	20.446 €
D	*PAYABLES*			
D.6	Advance payment		27.373 €	32.432 €
	within 12 months	27.373 €		32.432 €
D.7	Accounts payable to suppliers		224.771 €	236.838 €
	within 12 months	224.771 €		236.838 €
D.12	Taxes payable		8.283 €	5.408 €
	within 12 months	8.283 €		5.408 €
D.13	Social security payables		7.156 €	6.636 €
	within 12 months	7.156 €		6.636 €
D.14	Other payable		8.608 €	8.752 €
	within 12 months	8.608 €		8.752 €
Total PAYABLES			**276.191 €**	**290.066 €**
TOTAL LIABILITIES			**890.590 €**	**629.149 €**

FINANCIAL

INCOME STATEMENT

INCOME STATEMENT		At 31/12/2011		At 31-12-2010
		Partial	Total	
A	VALUE OF PRODUCTION			
A.1.	Net sales from production and services		211.140 €	236.325 €
A.3	Changes to contracted work in progress		13.308 €	57.439 €
A.5	Other revenues and income		289.089 €	198.824 €
A.5.a	Other contributions	258.091 €		198.824 €
A.5.b	Other operating revenues		30.998 €	
Total VALUE OF PRODUCTION			**513.537 €**	**492.588 €**
B	COST OF PRODUCTION			
B.6	Raw, ancillary, consumable materials/goods		24.291 €	6.117 €
B.7	For services		272.927 €	331.055 €
B.8	For leasing and rentals		4.755 €	5.654 €
B.9	For personnel		135.140 €	132.706 €
B.9.a	Salaries and wages		95.530 €	95.530 €
B.9.b	Social security contributions	31.411 €		29.873 €
B.9.c	Employee retirement indemnity	7.199 €		7.303 €
B.9.e	Other costs			
B.10	Depreciation and write-downs		29.296 €	22.402 €
B.10.a	Depreciation of intangible fixed assets	982 €		6.418 €
B.10.b	Depreciation of tangible fixed assets	28.314 €		15.984 €
B.14	Other operating expenses		5.766 €	34.401 €
Total COST OF PRODUCTION			**472.175 €**	**532.336 €**
Net income from operating activities			**41.362 €**	**-39.748 €**
C	FINANCIAL INCOME AND EXPENSES			
C.16	Other financial income		18 €	15 €
C.16.d	Other financial income	18 €		15 €
C.16.d.4	Income from other companies	18 €		15 €
C.17	Interest and other financial expenses	51 €		-10 €
C.17.d	Interest and other financial expenses	51 €		-10 €
C.17-bis	Profit and loss on exchange		3 €	-2.104
Total FINANCIAL INCOME (EXPENSES)			**36 €**	**-2.099 €**

FINANCIAL

INCOME STATEMENT

INCOME STATEMENT		At 31/12/2011		At 31-12-2010
		Partial	Total	
E	EXTRAORDINARY INCOME AND EXPENSES			
E.20	Extraordinary income			—
E.20.b	Other extraordinary income			—
E.21	Extraordinary expenses		—	—
E.21.b	Other extraordinary expenses		—	—
Net EXTRAORDINARY INCOME (LOSS)				
23	Net income (loss) for the year		41.326 €	-41.848 €

Notes to the balance sheet and the profit and loss account

General Accounting Principles

The accounts have been prepared on the basis of historical cost (except when stated otherwise). If not stated otherwise, assets and liabilities are shown at face value.

Principles for valuation of assets and liabilities

Tangible assets

Tangible assets are valued at cost less accumulated depreciation. The depreciation is calculated on a straight-line basis and based on an expected economic life of 3 - 5 years.

Work in progress

The work in progress comprises material costs and labour costs plus overhead pro rata. Provision is made for projects that cannot be covered by their revenues in the future.

Debtors-trade

Current assets include debtors, which fall due within one year. Provision is made for amounts that probably will not be received.

Principles for determination of results

Revenues and costs

Revenues and costs are allocated to the financial year to which they relate. Losses and risks are also recognised in the period to which they relate.

Total revenue

Total revenue comprises the invoiced fees from the Member Organisations, the invoiced amounts for other services rendered, and the change of work in progress. Revenues on work in progress are recognized at the time the projects are completed.

DIRECTOR'S COMMENTS ON THE IFRF'S FINANCIAL POSITION

A surplus of € 41.326 was achieved. This was below the budgeted figure of € 65.000. There were some differences compared to the budgeted figures, in particular:

- The budgeted research income of € 670.000 was actually € 513.536. This was because the expected funding from EU FP7 through the **RELCOM** and **BRISK** projects was delayed.

  Also some activity of burner testing for private clients was postponed in 2012.

- The expenses, too, were reduced from € 605.000 to € 472.175 for the reasons mentioned above.

- There was a shortfall on the budgeted figure for Members' fees of about € 15.000.

The cash available at the IFRF bank accounts on December 31st 2011 was € 327.688 compared with € 56.807 at December 31st 2010. The amount reflects an advance payment of some € 260.000 in respect of BRISK.

During the year, the IFRF took on certain commercial research projects within the scope of its non-profit nature. In addition one technical meeting and a course contributed positively to the organisation's financial position.

It can be reasonably assumed that during the course of 2012 the Foundation will continue to strengthen its capital position through careful management of its resources and to fulfill its mission both quantitatively and as regards increased efficiency.

Leo Tognotti
Director, IFRF

IFRF Doc N° K63/y/11
Livorno, June 2012

Annual Report 2011
Summary Financial Statements 2011

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Livorno, June 2012

Annual Report 2011
Summary Financial Statements 2011

APPENDIX

Papers and presentations at IFRF events

http://www.trends.ifrf.net

Estimation of Confidence in Experimental Data for Model Validation

A. Parente, C. Galletti, G. Coraggio. L. Tognotti, CFD Validation Workshop, Turku, June 2011

Validation of oxy-fuel combustion modelling via semi-industrial furnace tests

C. Galletti, A. Modesti, S. Pelagallo, L. Tognotti, CFD Validation Workshop, Turku, June 2011

Characterisation needs for modelling solid fuel combustion in industrial systems

L. Tognotti, CFD Validation Workshop, Turku, June 2011

Strategies and approaches for modeling full scale biomass co-firing

L. Tognotti, B. Risio, TOTeM 37, Wroclaw, September 2011

Development and Qualification of Conventional and Novel Industrial Combustion Test Probes

German Flame Day, Karlsruhe, September 2011

Development of novel instrumentation/ probes for oxy-fuel semi-industrial tests

G. Coraggio, L. Biasci, M. Faleni, L. Lupetti, L. Tognotti, IFRF 17th Member Conference, Paris, June 2012

Solid fuel databases: state of the art and evolution plan at IFRF

E. Biagini, L. Tognotti, IFRF 17th Member Conference, Paris, June 2012

Modelling oxy-coal combustion in a semi-industrial furnace

C. Galletti, L. Giovannini, G. Coraggio, L. Tognotti, IFRF 17th Member Conference, Paris, June 2012

Optimal choice of variables for the identification of chemical time-scales with detailed kinetic schemes

B. J. Isaac, C. Galletti, A. Parente, J. Thornock, L. Tognotti, P. J. Smith, IFRF 17th Member Conference, Paris, June 2012

Ignition delay of coal particle jets in oxy-fuel conditions

C. Galletti, S. Tarquini, R. Bruschi, G. Coraggio, S. Giammartini, L. Tognotti, IFRF 17th Member Conference, Paris, June 2012

Pilot scale biomass gasification at CRIBE: survey of the experimental activities

M. Simone F. Barontini, C. Nicolella, E. Biagini, L. Tognotti, IFRF 17th Member Conference, Paris, June 2012

Papers in International Journals

Multivariable optimization of reaction order and kinetic parameters for high temperature oxidation of ten bituminous coal chars

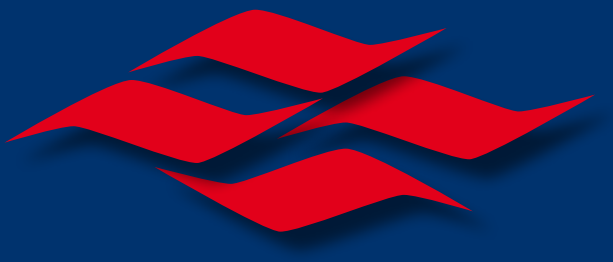
O. Karlström, A. Brink, M. Hupa, L. Tognotti, Combustion and Flame Volume 158, Issue 10, October 2011

One-Parameter Model for the Oxidation of Pulverized Bituminous Coal Chars

O. Karlström, A. Brink, J. Hercog, M. Hupa, L. Tognotti, Energy Fuels, 2012

Comparing reaction orders of anthracite chars with bituminous coal chars at high temperature oxidation conditions

O. Karlström, A. Brink, M. Hupa, L. Tognotti, E. Biagini, XXXIV Symp. Comb. 2012



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