



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Experience and findings as users within SFERA

Elisa Sani, Luca Mercatelli

Email: elisa.sani@ino.it

INO-CNR
National Institute of Optics,
Largo Enrico Fermi 6,
50125 Firenze (Italy)



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Outline

The SFERA Access program

Our 2010 SFERA measurement campaign

Benefits for users of the SFERA Access program

Scientific results

Our 2011 SFERA measurement campaign



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Our SFERA experience





INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

The 2010 SFERA measurement campaign

ULTAC-SOF proposal

Ultra-high Temperature Absorber Ceramics for Solar Furnaces

Experimental facility:

the MegaWatt Solar Furnace of PROMES-CNRS, Font Romeu (France)



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

PROMES CNRS MegaWatt Solar Furnace



ULTAC-SOF proposal, SFERA 2010



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

MegaWatt Solar Furnace: Heliostats

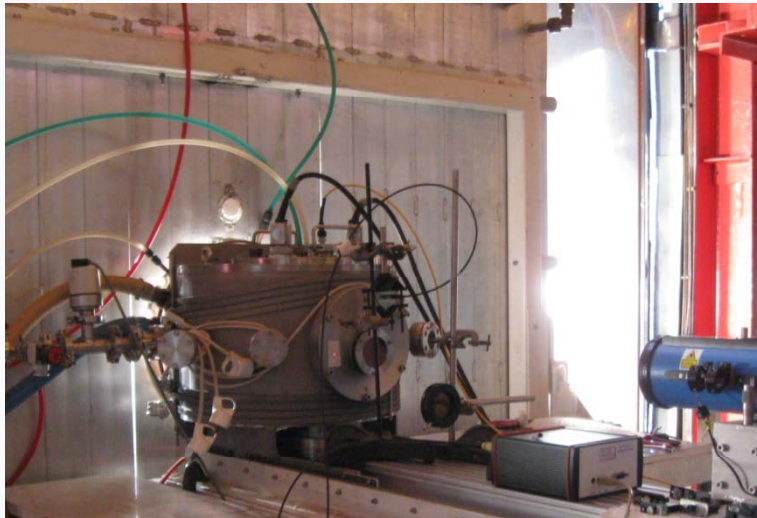


ULTAC-SOF proposal, SFERA 2010



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

MegaWatt Solar Furnace: the Focus



ULTAC-SOF proposal, SFERA 2010



Benefits for users I

- **A unique facility**
- **Many year-long development and strong optimization of the experimental setup**
- **Good scientific results even for short measurement campaigns**
- **International & multidisciplinary context**
- **Discussion with experts. Planning and carrying out of complementary scientific activities. Maximization of scientific results**



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Benefits for users II

- **No logistics or practical problems: every practical life issue already solved (accommodation, travels, ...)**

- **... Very nice place**



ULTAC-SOF proposal, SFERA 2010



ULTAC-SOF

Ultra-high Temperature Absorber Ceramics for Solar Furnaces

Aimed to investigate the possibility to use innovative materials such as Ultra-High-Temperature Ceramics as direct sunlight absorbers in high-temperature thermodynamic solar plants.

UHTCs are characterized by some of the highest melting points of known materials and other favorable characteristics.

Already used for extreme conditions (aerospace, military...)



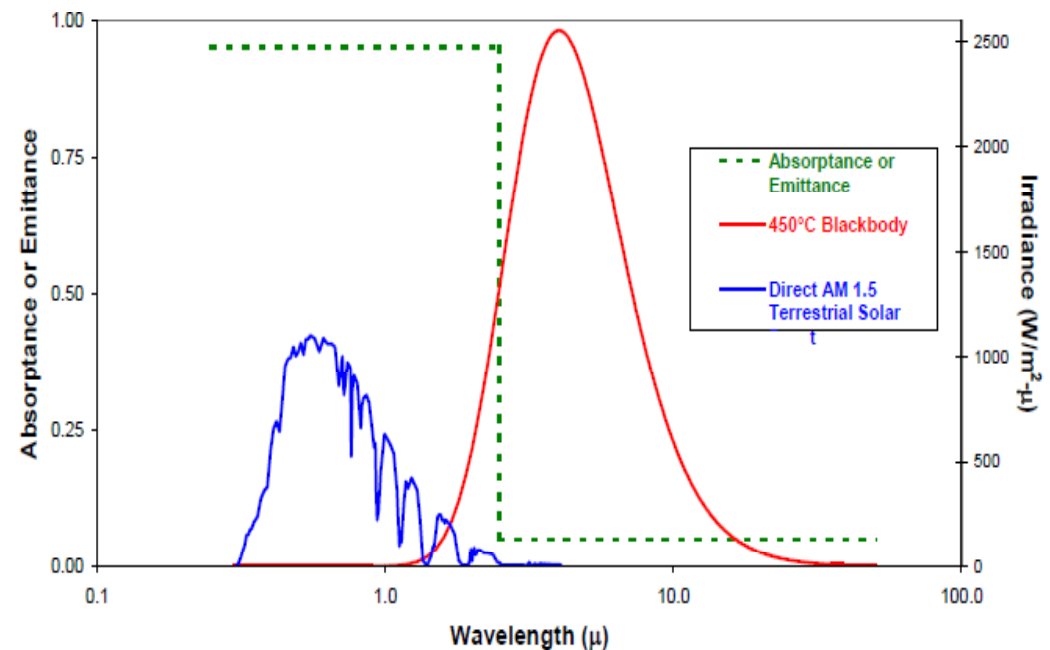
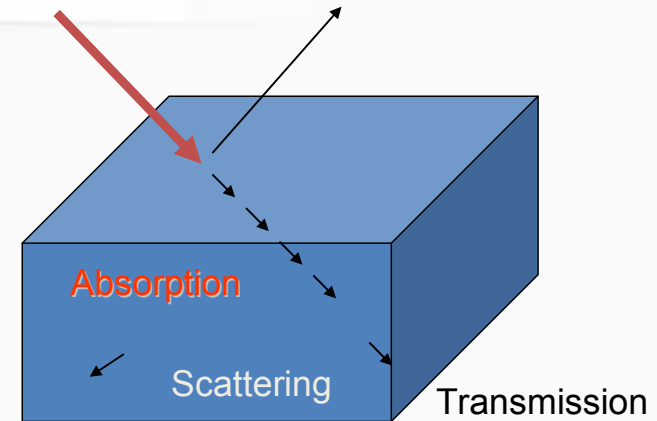
Materials for solar absorbers

For efficient photothermal conversion, solar absorbers should have:

High solar absorbance ($\alpha \sim 0.95$)

Low thermal emissivity ($\epsilon < 0.1$)

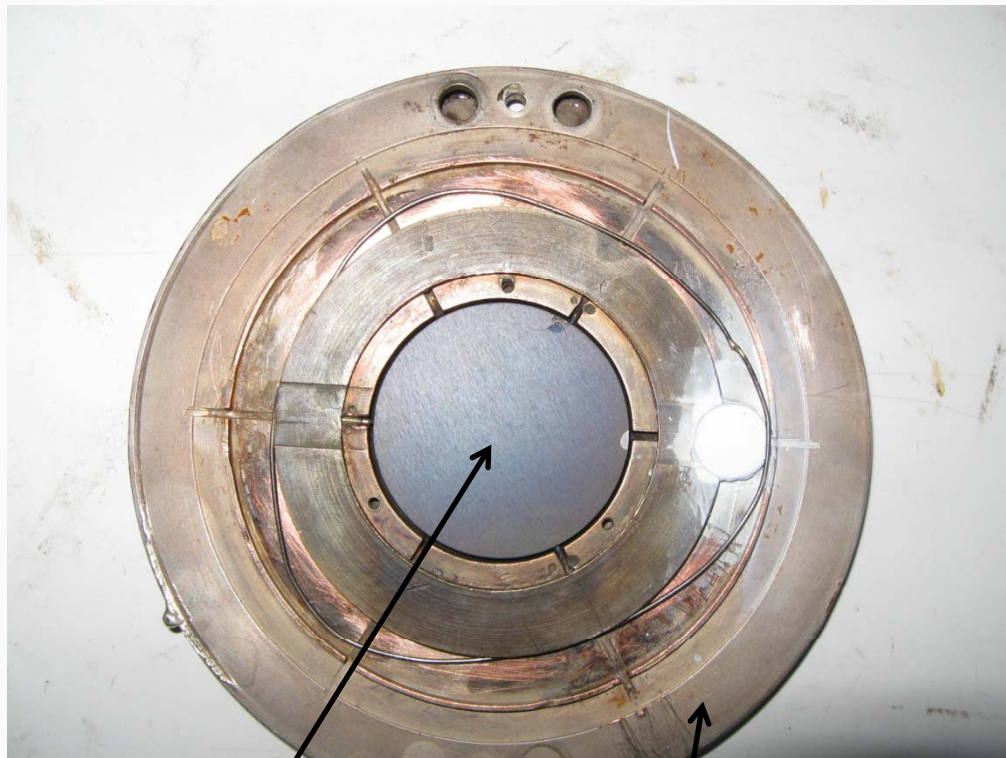
at the working temperature.





INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

UHTC samples



SAMPLE

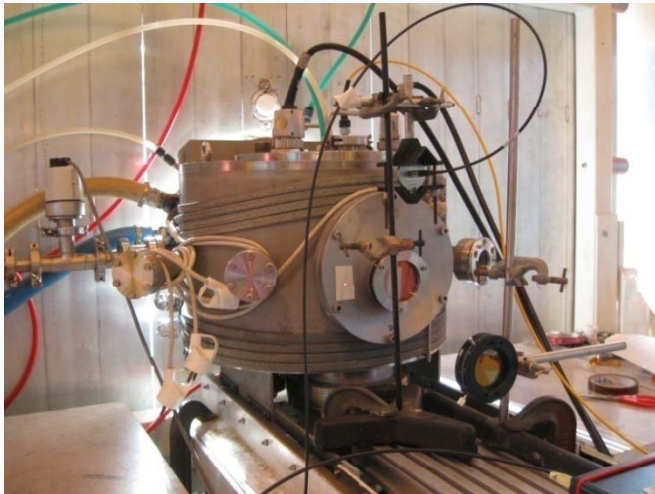
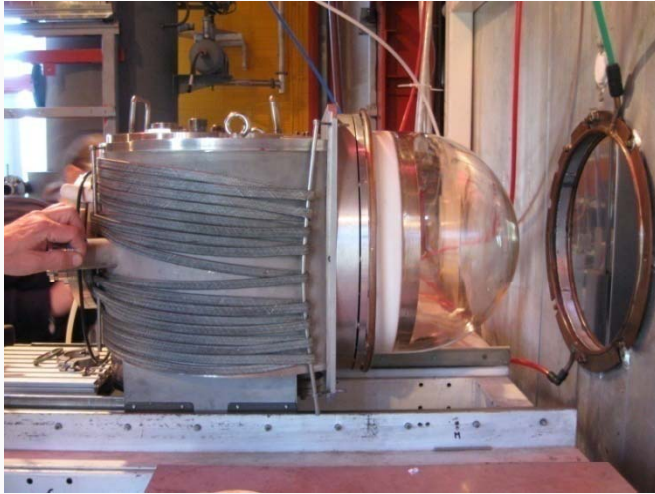
SAMPLE
HOLDER

ULTAC-SOF proposal, SFERA 2010



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA











High-temperature emissivity measurement



ULTAC-SOF proposal, SFERA 2010

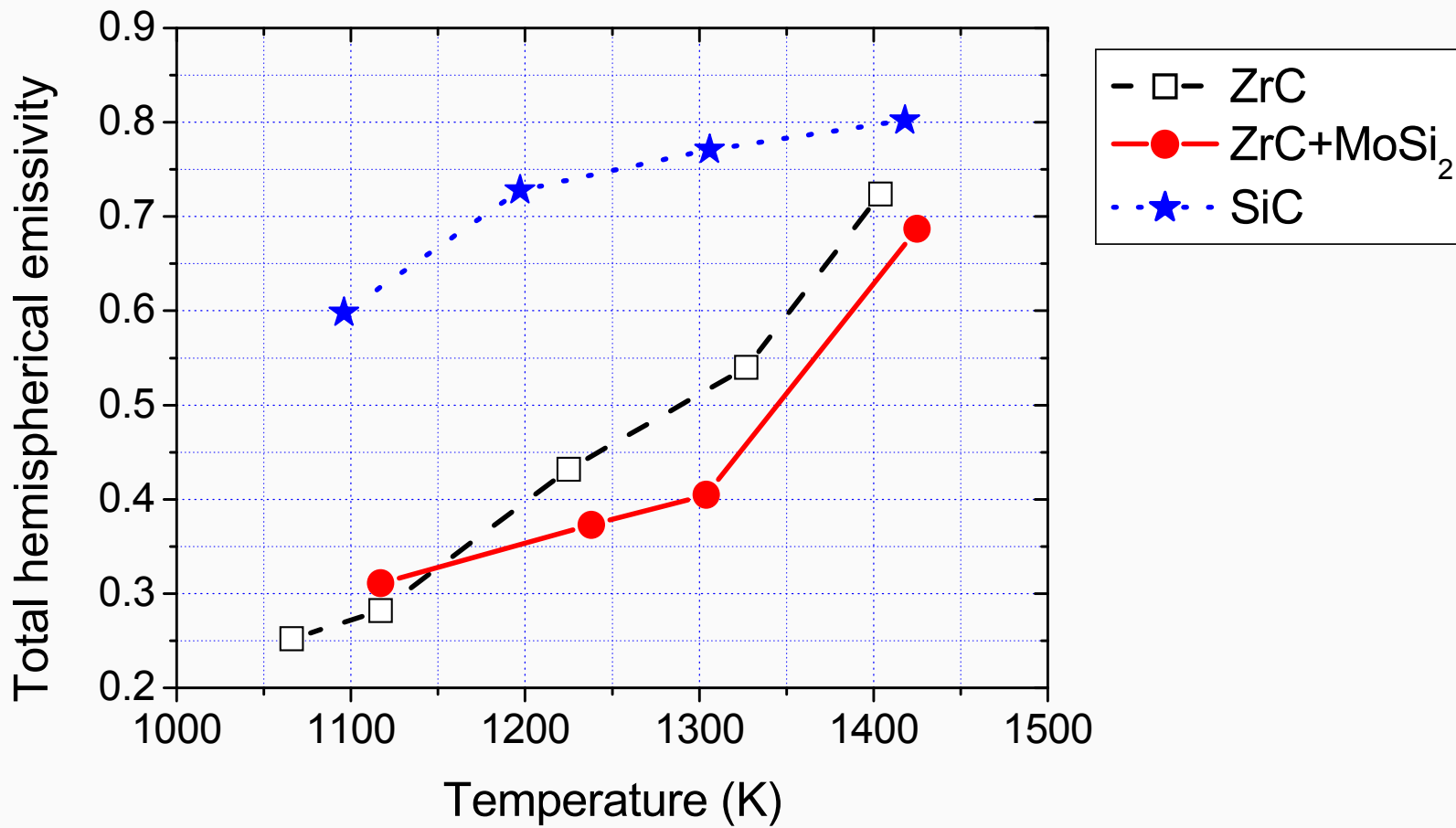


Timetable

Day	Tuesday	Wednesday	Thursday	Friday	Saturday
	Sept. 07, 2010	Sept. 08	Sept. 09	Sept. 10	Sept. 11
What	Calibration	Calibration	HW problems	Measurements	Measurements
Weather					
Day	Monday	Tuesday	Wednesday	Thursday	Friday
	Sept. 13	Sept. 14	Sept. 15	Sept. 16	17-set-10
What	Measurements	Measurements	Measurements	Directional reflectometry	Discussion
Weather					

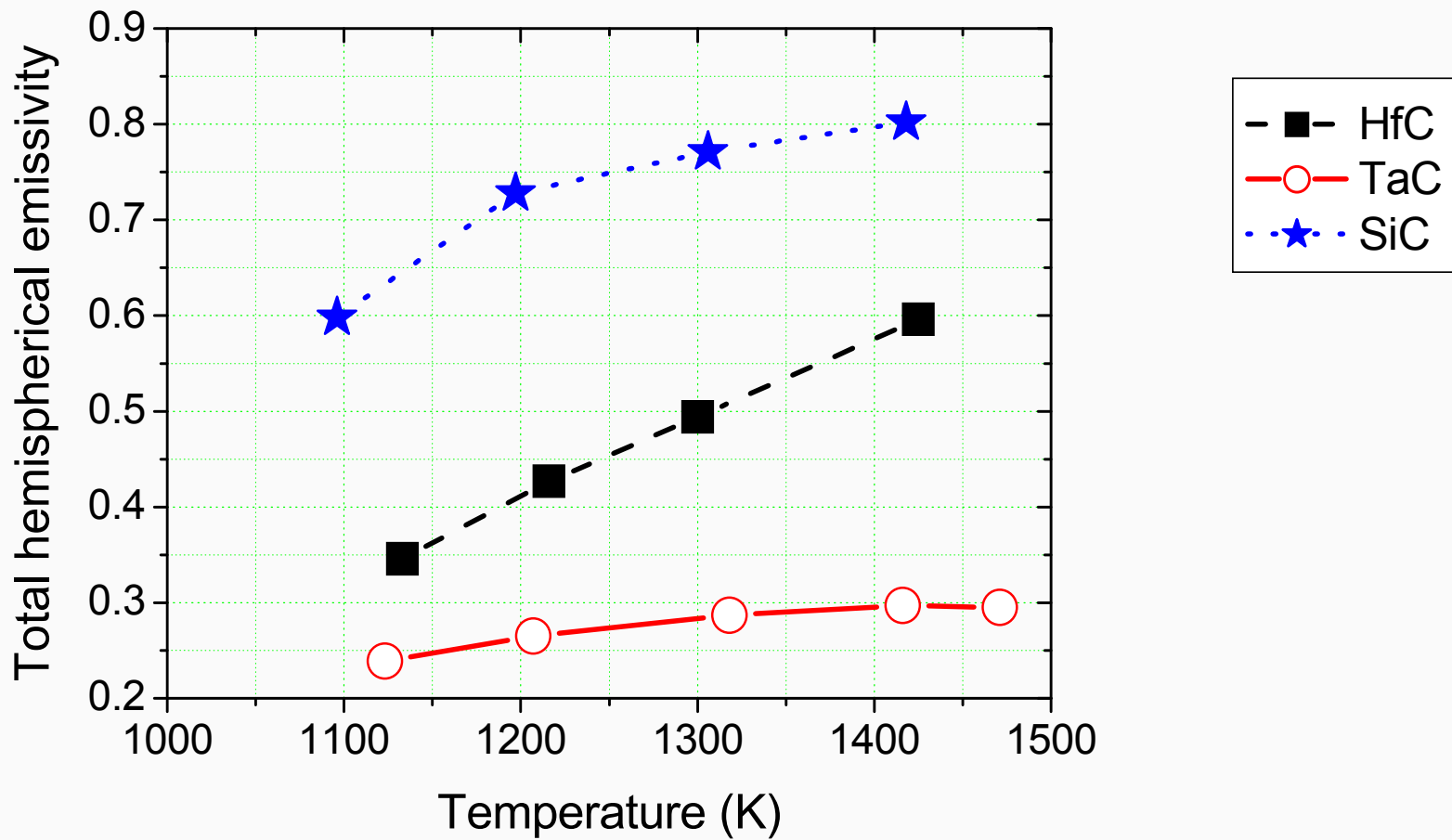


Results I





Results II





INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Publications

- Papers from the 2010 SFERA-funded activity:
1 published, 1 submitted, 2 in preparation



Available online at www.sciencedirect.com



Scripta Materialia 65 (2011) 775–778



Scripta MATERIALIA

www.elsevier.com/locate/scriptamat

Ultra-refractory ceramics for high-temperature solar absorbers

E. Sani,^{a,*} L. Mercatelli,^a F. Francini,^a J.-L. Sans^b and D. Sciti^c

^aCNR-INO National Institute of Optics, largo E. Fermi, 6, 50125 Firenze, Italy

^bPROMES-CNRS Processes, Materials and Solar Energy Laboratory, 7 rue du Four Solaire, 66120 Font Romeu, France

^cCNR-ISTEC Institute of Science and Technology for Ceramics, Via Granarolo 64, 48018 Faenza (RA), Italy

ULTAC-SOF proposal, SFERA 2010



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

The 2011 SFERA measurement campaign

DAITARN proposal

Density and roughness Analysis In ultra high Temperature cerAmics for solaR applications

Experimental facility:

the MegaWatt Solar Furnace of PROMES-CNRS, Font Romeu (France)

(currently under way)



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA

Acknowledgements

- The EU-SFERA Access program;
- Dr. Gilles Flamant, Director of PROMES-CNRS;
- Dr. Jean-Louis Sans (PROMES-CNRS);
- Ms. Marie Prouteau (PROMES-CNRS);
- Dr. Daniel Hernandez, Dr. Eric Beche (PROMES-CNRS);
- All the PROMES personnel: scientific & administration-support;
- Dr. Diletta Sciti (ISTEC-CNR, Italy);
- Solar Paces 2011.



INO-CNR
ISTITUTO
NAZIONALE DI
OTTICA



ULTAC-SOF proposal, SFERA 2010



Room temperature reflectance spectra

