

CESI materials research for Gas Turbines

**Contribution to the 2nd workshop
of CAME -GT thematic network**

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CAME GT

CESI ₁

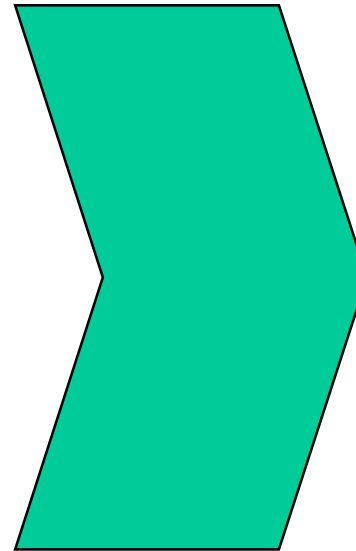
CESI: the merger

1999

**CESI= Centro
Elettrotecnico
Sperimentale Italiano**

**Part of ENEL-research
(including CISE S.p.A.)**

From 01- 2000



CESI

CAME GT

CESI 2

CESI

What is

R&D Activities oriented to technological innovation of the electric sector whose results and solutions may be used in a long term view.

...dealing with...

The network, the interaction between power plants and the environment, the end uses of electricity, the generation process and studies of innovative components.

...devoted to...

National electrical system users and contextually specific operators in the national and/or international electricity sector.

...financed by...

- ◆ **General charges on the electrical system:** The Gov. Disposal 26/1/2000 assigns to CESI the Public Interest Research
- ◆ **Funds and different sources connected to EU financing.**

NATIONAL RESEARCH on ADVANCED GAS TURBINES

- ✓ **materials and coatings**
 - **characterization**
 - **life assessment techniques**
 - **innovative repair and coating processes**
- ✓ **NDT and monitoring**
 - **NDT on hot parts during inspections**
 - **on line monitoring**
- ✓ **cathalytic combustion on industrial GT**

NATIONAL RESEARCH (RdS)

☐ Materials and coatings characterization

- ✓ mechanical characterization of single crystal**
- ✓ laser thermal shock/fatigue on coatings**
- ✓ thermophysical measurements**

☐ Advanced repair techniques

- ✓ laser cladding (also on single crystal)**
- ✓ HVOF instead of VPS**
- ✓ shrouded arc wire (pure coat) of NiCrAl**

INNOVATIVE REPAIR

ongoing studies on SC materials

**Example
of laser
cladding
on a
blade tip**



NATIONAL RESEARCH (RdS)

☐ NDT on components (maintenance)

- ✓ thermography and FSECT on hot parts**

☐ on line monitoring

- ✓ optical pirometry (T of rotating blades)**
- ✓ ITT direct measurement (optical fiber sens.)**
- ✓ EDMS =engine distress monitoring system (detached particles from hot parts)**
- ✓ clearances monitoring by capacitive sensors**

F-SECT

(frequency scanning eddy current technique)

Thickness and β -phase depletion measurement of protective coatings applied on gas turbine blades



Participation to COST 522 Gas Turbine Working Group

- to WP1 blades/vanes with project I103:
*mechanical and microstructural
characterization of a single crystal alloy*
- to WP2 protective systems with project
I202:
*thermophysical property assessment of
new TBCs*

CESI PARTICIPATION in FP IV PROJECTS

- SHROUD** (coordinator-innovative shrouded thermal spray techniques)
- DEPAC** (partner for metallography, CVD aluminizing)
- DIFFBAR** (partner for hot corrosion tests)
- PROTECT** (partner for metallography , thermophys. meas., NDT by thermography of CVD thermal barriers) - ongoing

CESI PARTICIPATION in FP V

❑ GROWTH--- M&T

- ✓ COTEST (Cyclic oxidation test procedures)
- ✓ TMF standard (Ther. fatigue test proc.)
- ✓ CRETE (creep crack growth st.)-coord.

❑ GROWTH ----TN

- ✓ FINET (fitness for service of ind. comp.)
- ✓ ADVANCED CREEP

CESI: EXPERIENCES IN THE FIELD of GT

- **Long term experience on mechanical tests, high temperature corrosion, repair**
- **Test Facilities: MD Hot corrosion, cyclic oxidation, burner rig, creep, LCF, laser thermal shock**
- **Repair facilities: high power lasers, HVOF**
- **Characterization facilities: Microscopy, SEM, XRD, Thermophysical properties**
- **Participating/Coordinating European Programs /Projects (COST, BRITE-Euram, ...)**

HIGH TEMPERATURE CORROSION LAB.

- **6 Furnaces with 3 or 5 heating zones**
- **Temperature up to 1500°C**
- **Fully controlled experimental conditions**
- **Operation with aggressive environments**
- **toxic and flammable gases can be managed**

NON DESTRUCTIVE TECHNIQUES

- **Traditional (LP, US, ...)**
- **Acoustic Emission**
- **Pulsed Termography**

CYCLIC OXIDATION FACILITY

- **Moving vertical furnace with 3 heating zones, 25 samples batches**
- **Temperature: up to 1200°C**
- **On-line weight measurement**
- **Computer controlled process (temperature, weight, dwell time, air cooling valve, furnace movements, n°of samples..)**