






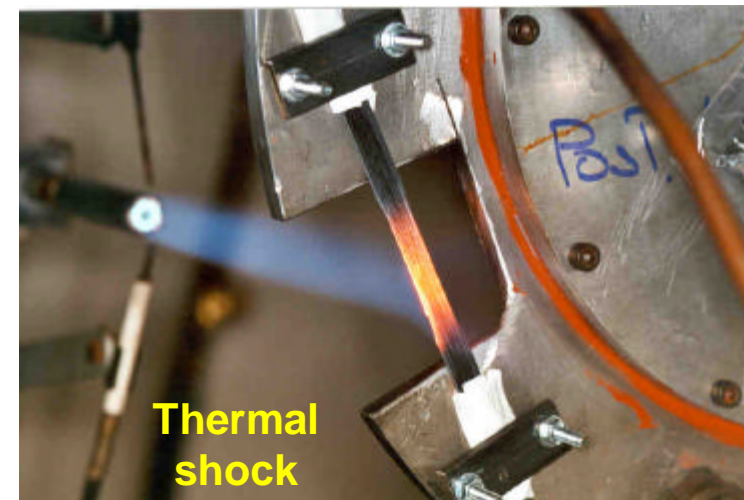
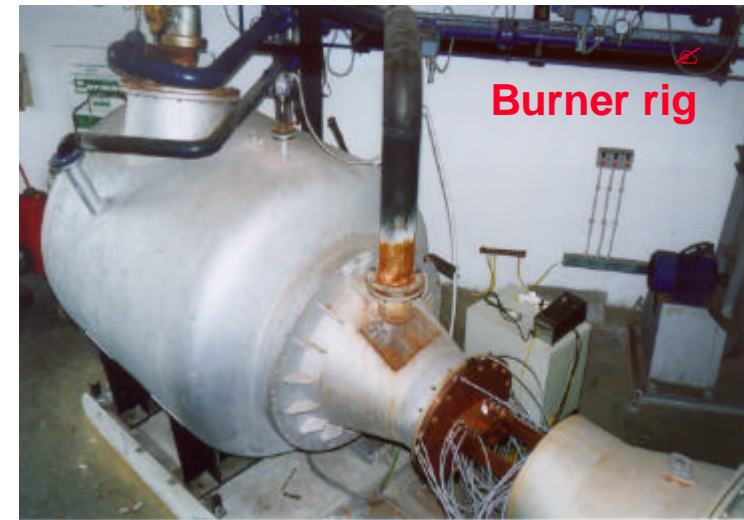
Gas turbine materials research at ARI : CMC materials



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Brite-Euram project “CMC Lifing” :

-  Title : Development of a lifing methodology for ceramic matrix composites in aero gas turbine engines.
-  Coordinator : Rolls-Royce
-  Objectives :
 - assessment of degradation mechanisms
 - generation of properties database
 - identification of design criteria
 - life prediction model
-  Materials : SiCf/SiC with multi-layer matrix and coating and oxide/oxide CMC
-  Tasks at ARI :
 - burner rig test and characterisation
 - thermal shock of coupons for mechanical tests
 - assessment of model applicability to power generation








Gas turbine materials research at ARI : ceramic to metal brazing








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Brite project “HITEB” (94-98) :

-  Title : High temperature bonding of advanced materials for power generation plants.
-  Coordinator : Ansaldo Ricerche
-  Objective (for ARI) : to improve the ceramic to metal joining technologies for high temperature applications and to assess their applicability to gas turbine components.
-  Materials : Al_2O_3 to IN738 and Nimonic PK33, SiCp/ Al_2O_3 to PK33 and SiCf/ Al_2O_3 to PK33.
-  Achieved results :
 - interlayers are necessary
 - preparation of surfaces is a key factor
 - small tiles have been produced and tested for thermal shock

Brite project “Almejo” (1998-2000) :

-  Title : Advanced alumina to metal joining for high temperature performance components.
-  Coordinator : Thomson Tubes Electroniques
-  Objective (gas turbine application) : construction of a capacitive sensor for measuring blade-tip to casing clearance in gas turbines.
-  Materials : Pt / Pd-Mg alloy / Al_2O_3
Pt / Pd-Cr alloy / Al_2O_3
-  Activities at ARI :
 - corrosion test in burner rig
 - oxidation test in furnace
 - thermal shock test
 - pre- and post-test characterisation

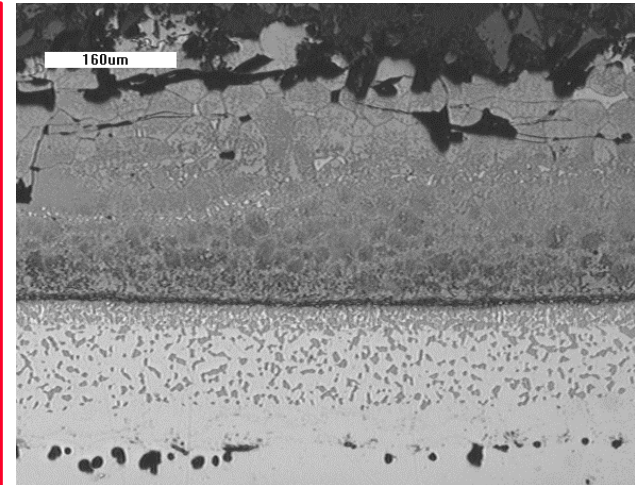
Gas turbine materials research at ARI : repair technologies



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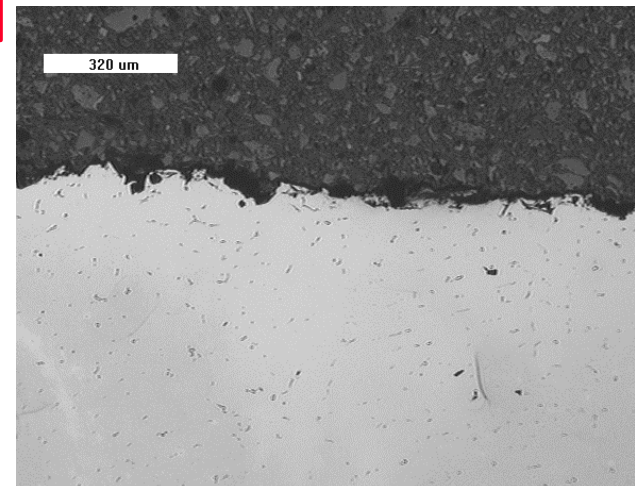
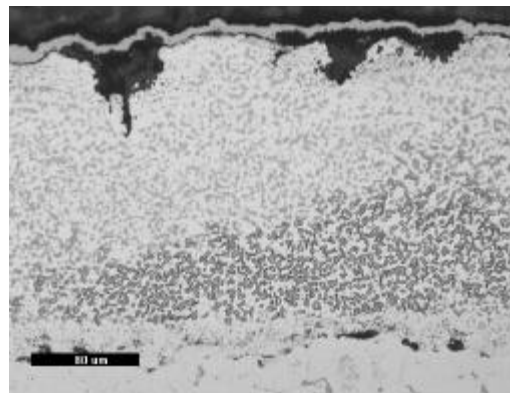
✂ Stripping of ex-service CoNiCrAlY+M coatings (2000) :

- ✂ Activity funded by Atla (coating and repair shop, SME).
- ✂ Methodology :
 - preliminary cleaning (sandblasting)
 - aluminium deposition (plasma spray or slurry)
 - diffusion heat treatment
 - removal of the brittle aluminized coating by sandblasting



Aluminized coating
OM x100

Ex-service coating
OM x200



Stripped blades
OM x50

Gas turbine materials research in Italy : funding opportunities



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- ✍ No funding opportunities specially devoted just to gas turbines development are available in Italy; funding has to be searched for through general programmes for advanced materials.
- ✍ Funding opportunities of interest for gas turbine materials are listed below :
(only on-going or future programmes are included)
 - ✍ CNR (National Council for Research) Second Finalized Project “Special Materials for Advanced Technologies”
 - Notes : projects started in 1998; eligible projects have to be focused on basic research; typical funding has been about 50000 Euro per partner and per year (for a 3 years project).
 - ✍ A Special Funding of the Italian Department of University and Research for advanced materials has been open for proposals during the first 3 months of 2001.
 - a proposal for a 3 years project about gas turbine materials (both TBCs and CMCs) has been submitted by a consortium.
 - ENEA is coordinator, ARI and ATLA are industrial partners.

Gas turbine materials research in Italy : funding opportunities



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Funding opportunities (continue) :


Law for funding or R&D activities of Small and Medium Enterprises :

- Italian Government funds up to 60 % of R&D activities of SMEs, if these activities are performed by approved laboratories
- ARI is an approved laboratory
- Coatings and mechanical shops in Italy often are SMEs

On-going research projects at Nuovo Pignone



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 In the following a list of on-going research projects at Nuovo Pignone is reported :

 EU funded projects :

- CERCO (oxide-oxide CMCs materials for combustors and shrouds)
- CINDERS (SiC-SiC CMCs materials for combustors)
- PROTECT (CVD for TBC deposition)
- ALLBATROS (long life coatings for gas turbine buckets)

 CNR project :

- Advanced TBC (ceramic layer with infiltrated oxides)