

October 2015

## RSE activities on microturbines (MT)

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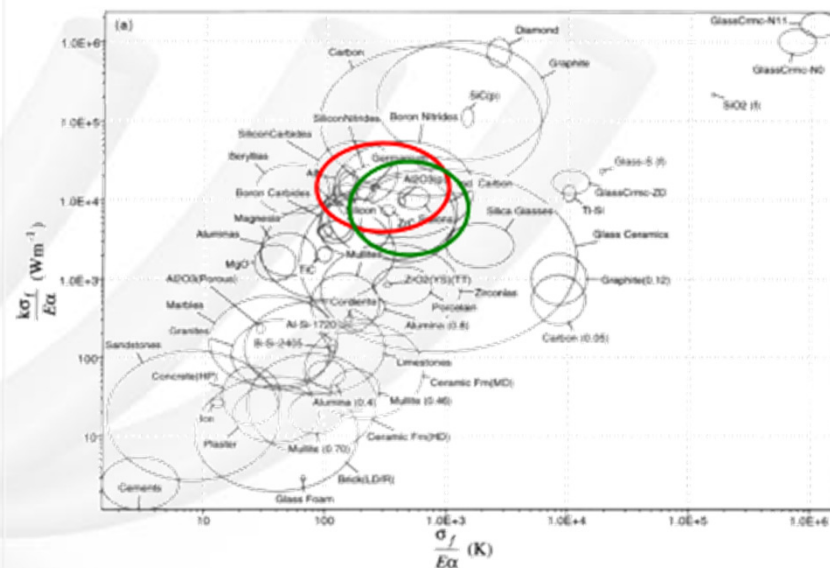
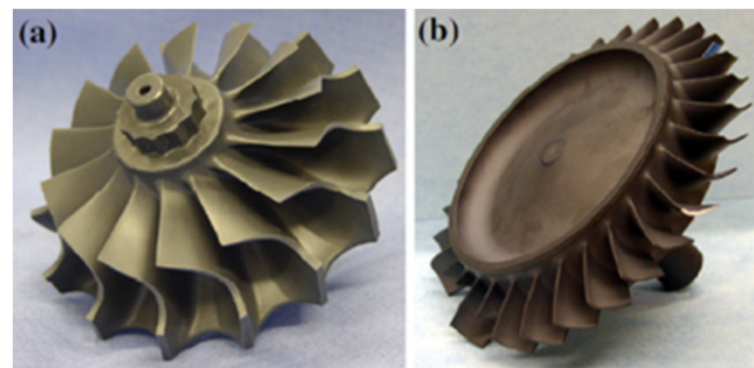
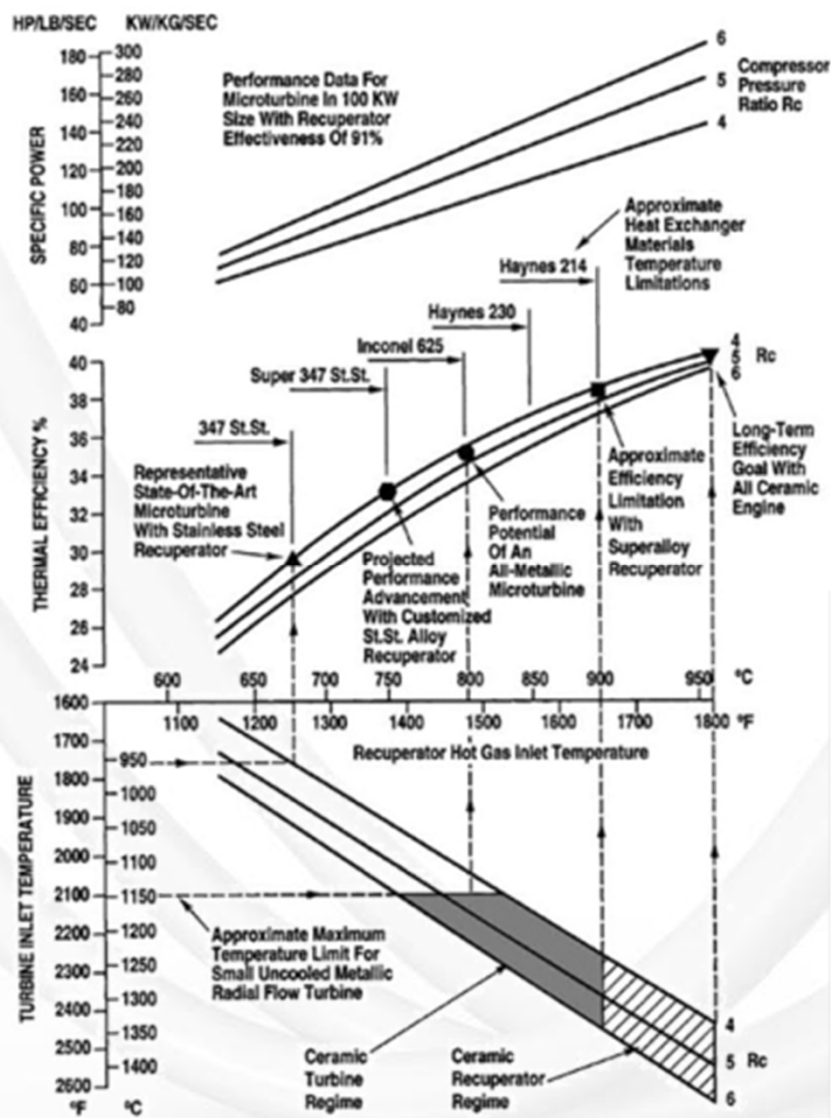
RSE Spa Via Rubattino, 54, 20134 Milano, Italy





## Studies on materials and coatings for a ceramic MT-1

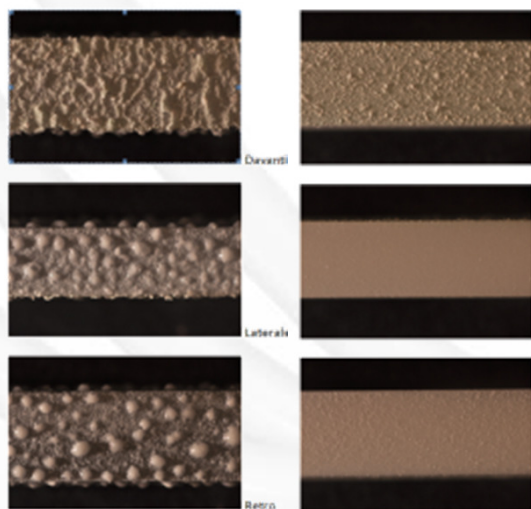
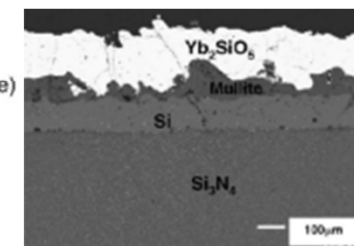
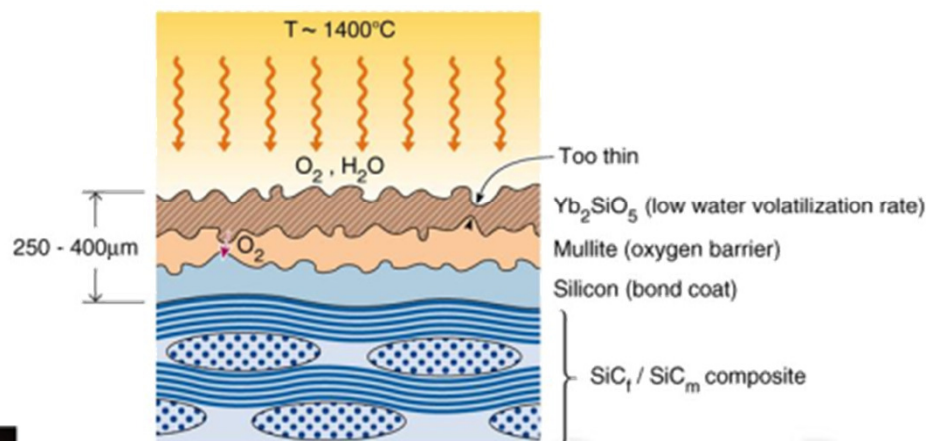
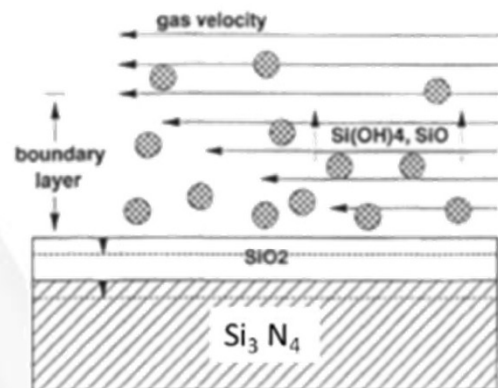
DoE funded project in USA



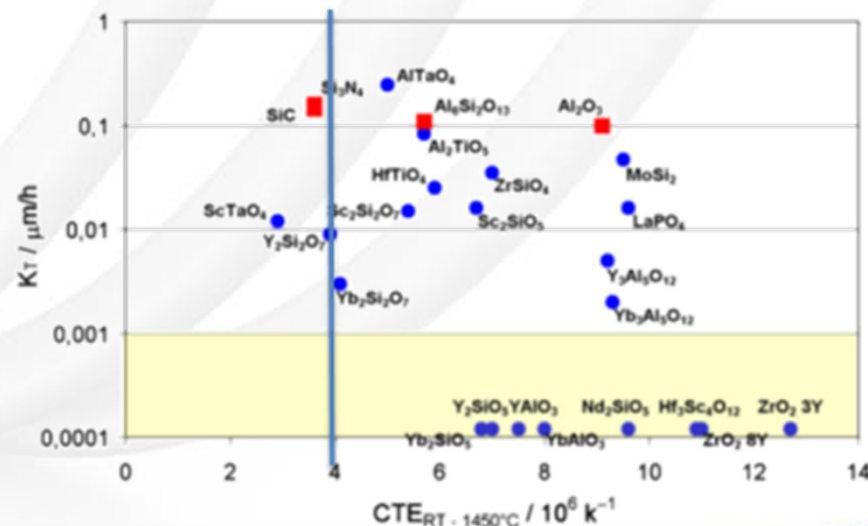


## Studies on materials and coatings for a ceramic MT-2

### Recession of non oxide ceramics at temperatures higher than 1150°C



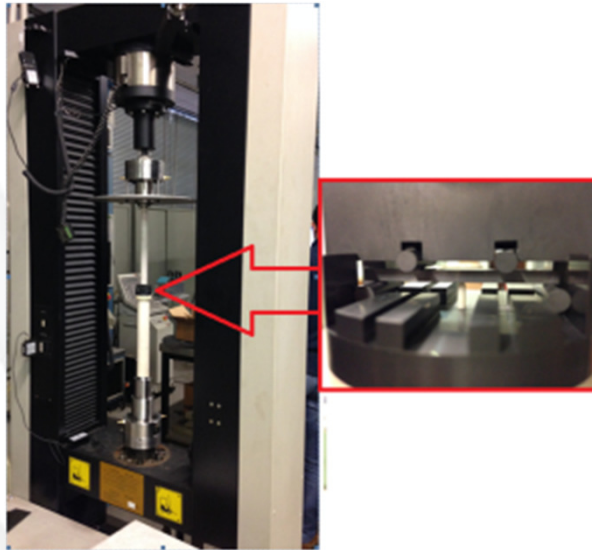
Non oxide and oxide ceramics





## Studies on materials and coatings for a ceramic MT-3

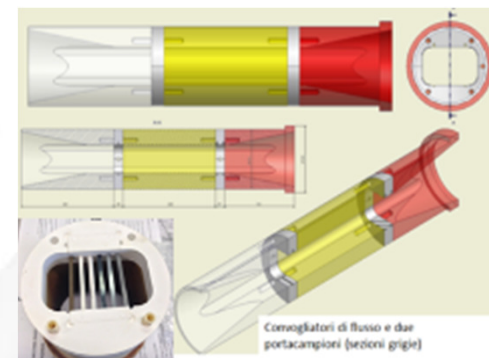
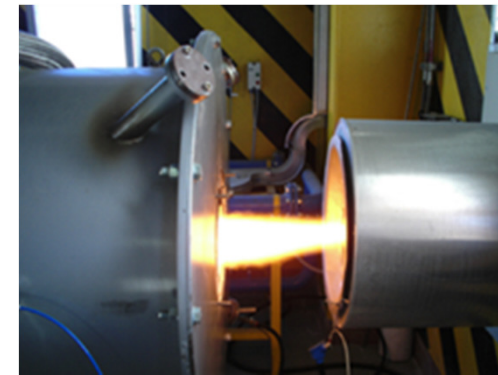
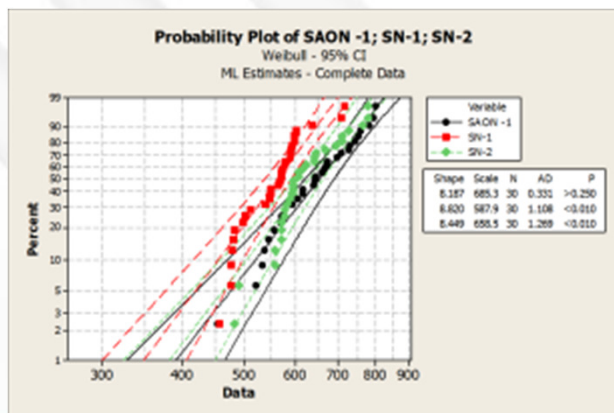
### RSE facilities&expertise



RT and HT 4 point bending test  
ASTM C1161-13&C1211-13



Thermal shock ASTM  
C1525-04



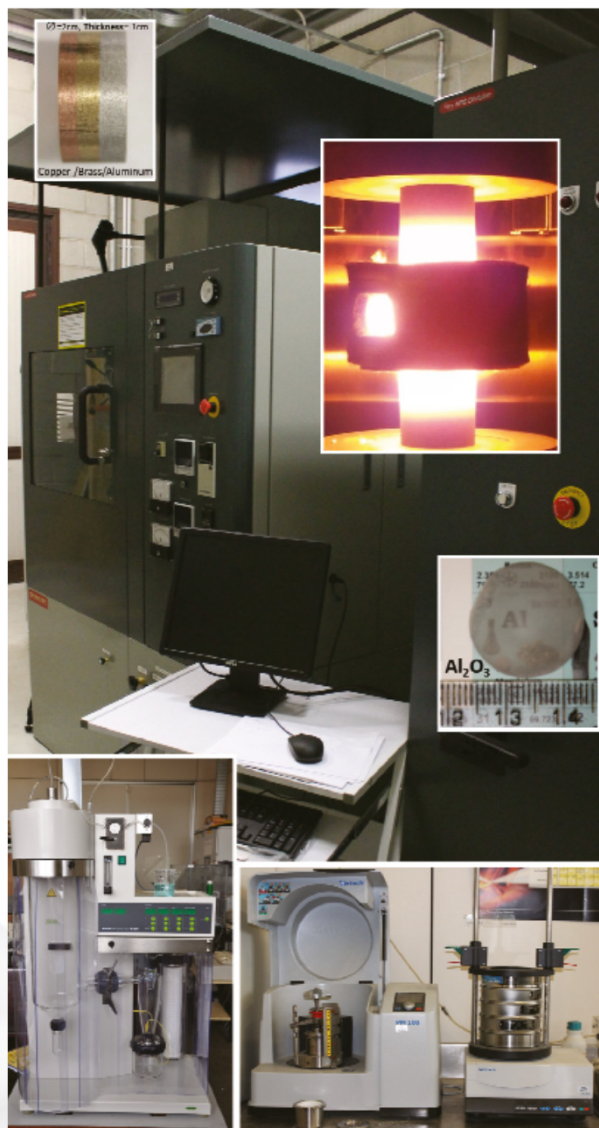
Burner rig with tunable  
steam content up to  
1400°C



Studies on materials and coatings for a ceramic MT-4

## RSE facilities&expertise

Spark Plasma Sintering for sintering advanced ceramics, metallic, and composite components



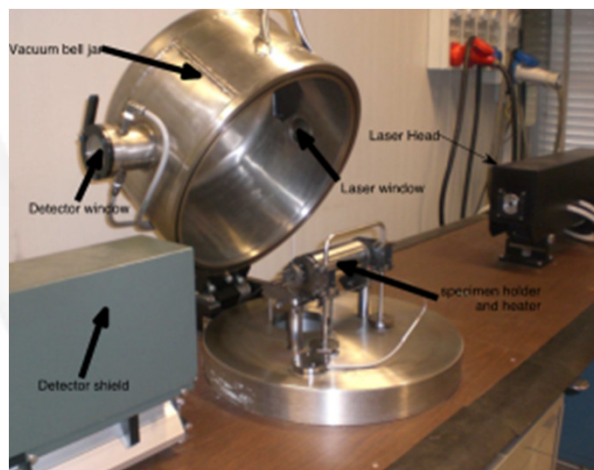
TGA for oxidation/corrosion kinetics studies



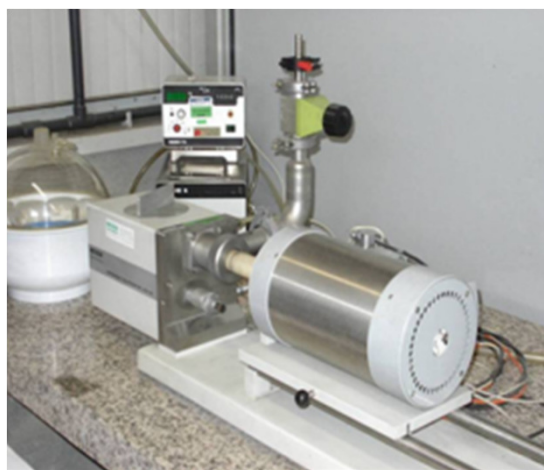


Studies on materials and coatings for a ceramic MT-5

RSE facilities&expertise



Laser Flash for thermal diffusivity measurement



Differential Dilatometer for TEC



Differential Scanning Calorimeter for  $C_p$



Plant configuration and materials issues related to externally fired MT-1



To extend fuels for MT to solid biomass and waste, external combustion is an option

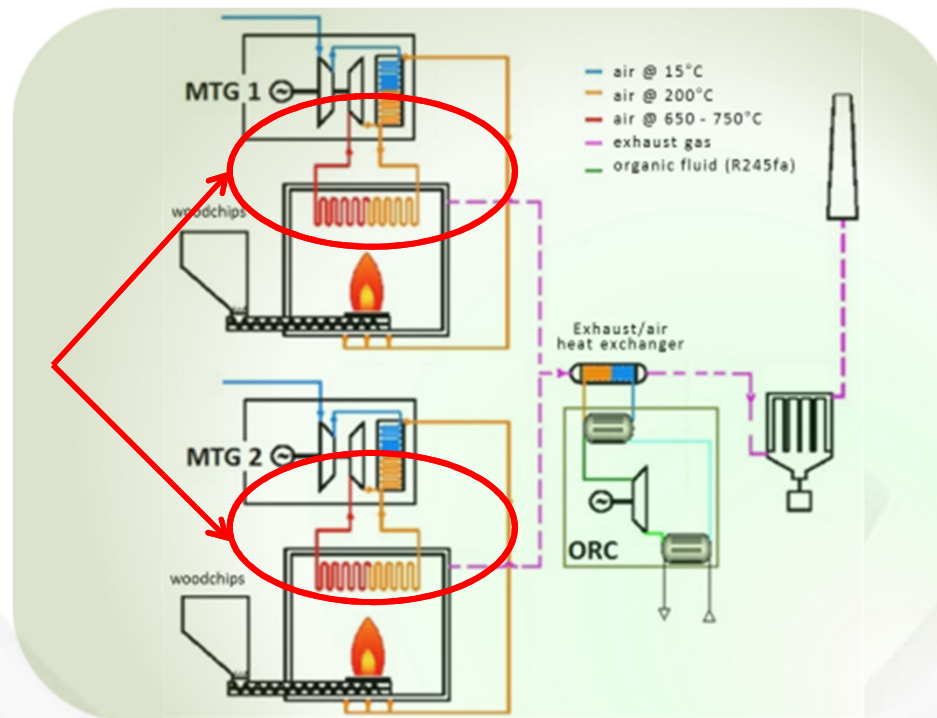


Two  $80\text{kW}_{\text{el}}$  MT+ $110\text{kW}_{\text{el}}$   
Rankine organic Fluid cycle  
fuelled by wood chips located  
in Zibello (PR-Italy)



## Plant configuration and materials issues related to externally fired MT-2

Possible  
issues



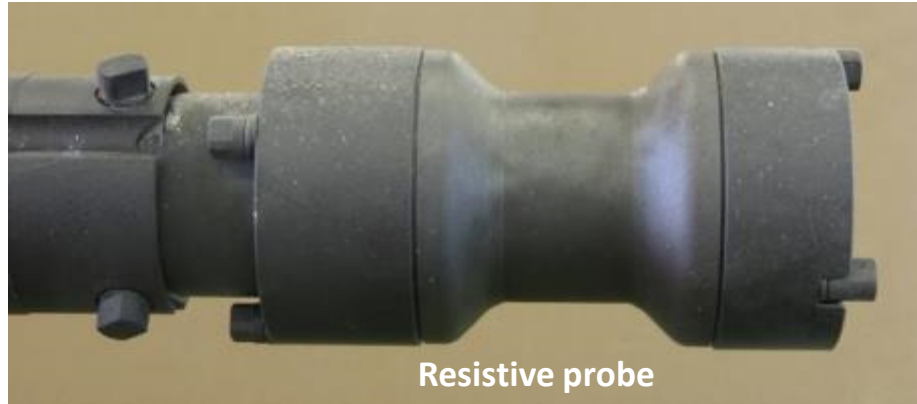
- Fire side hot corrosion
- Air side high temperature oxidation
- Turbine solid particle erosion (SPE)



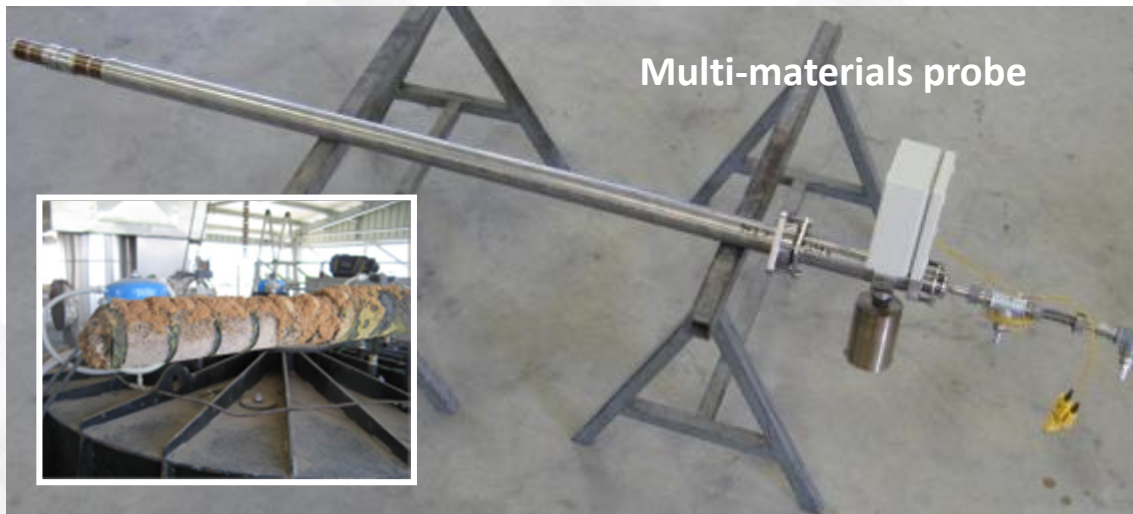
SPE erosion of MT  
vanes



Plant configuration and materials issues related to externally fired MT-3  
RSE facilities&expertise



Cooled probes for hot corrosion and high temperature oxidation monitoring to be installed in plants

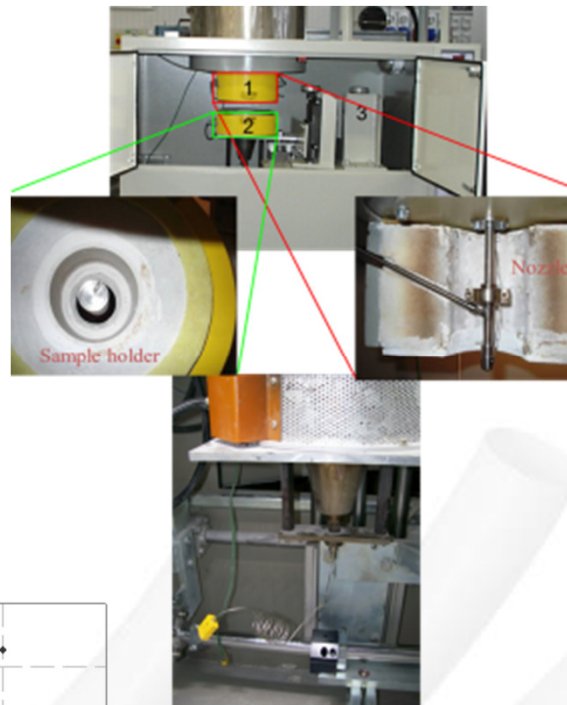




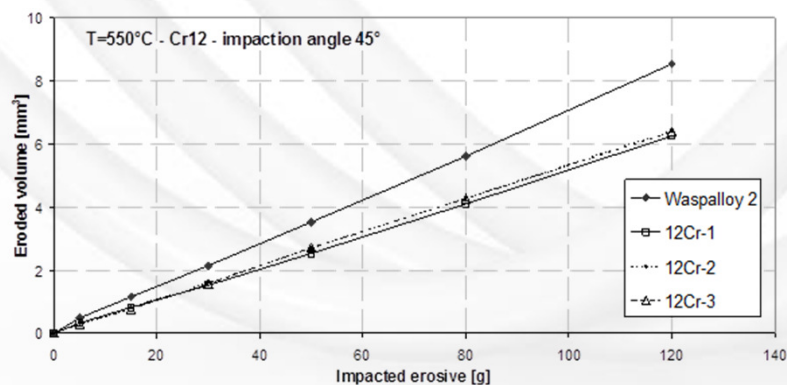
## Plant configuration and materials issues related to externally fired MT-4 RSE facilities&expertise



### High temperature solid particle erosion Jet Tester according to ASTM G211-14



Thermocouple in contact with the rear face of the sample



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Plant configuration and materials issues related to externally fired MT-5  
RSE facilities&expertise



TGA for oxidation/corrosion  
kinetics studies



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