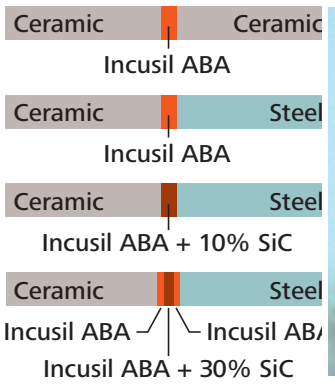
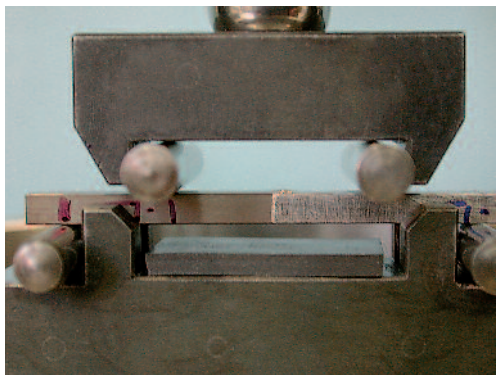
Brazing of Silicon Nitride Ceramic Composite to Steel using SiC-particle-reinforced active Brazing Alloy

EMPA
Materials Science & Technology

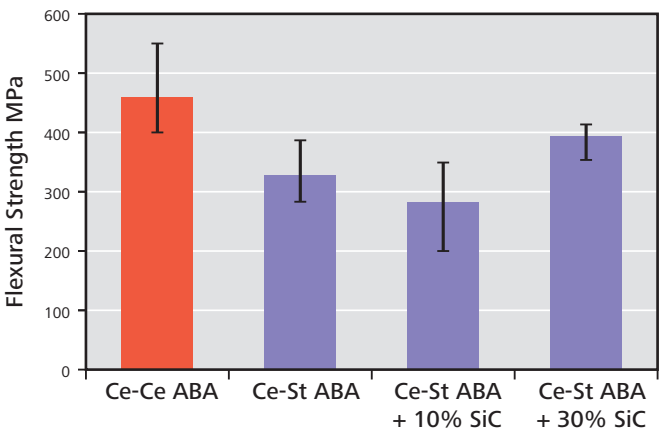
Gurdial Blugan[1], Jakob Kuebler[1*], Vinzenz Bissig[2], Jolanta Janczak-Rusch[2]

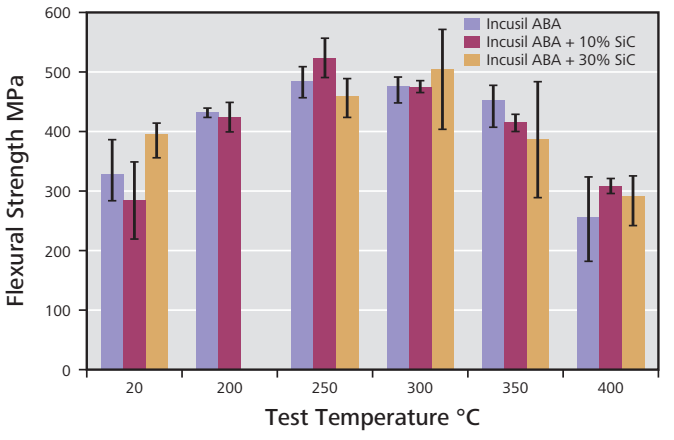
Steel (14NiCr14) has been joined to Si_3N_4/TiN ceramic composites using particle reinforced active brazing. SiC particles were added to Incusil ABA brazing alloy (Ag 59.0 wt.%, Cu 27.25 wt.%, In 12.5 wt.% and Ti 1.25 wt.%).



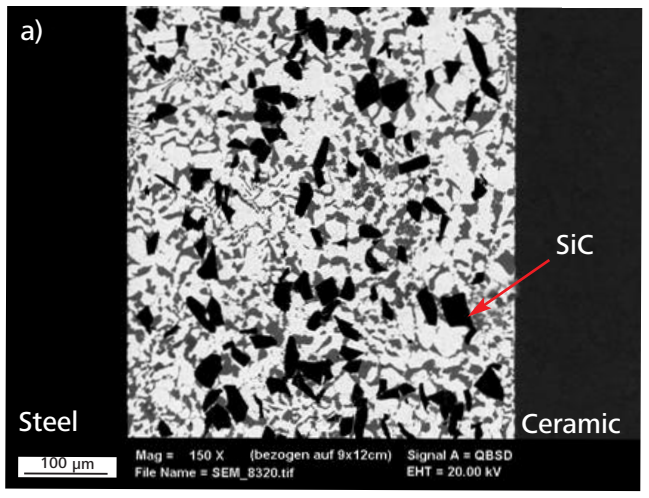


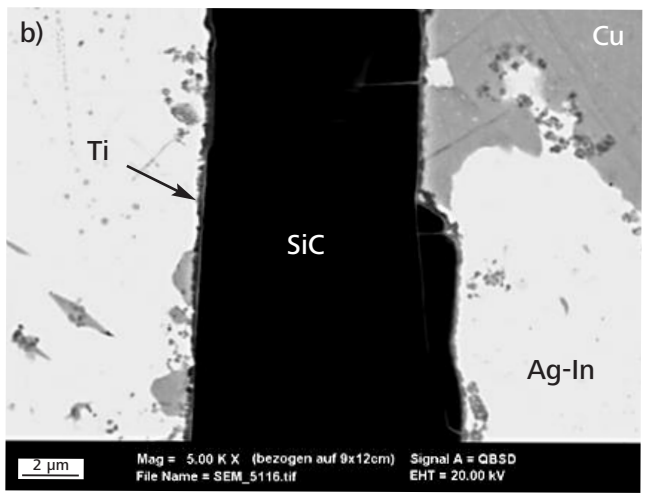
The brazed joints were tested for four point bending strength at both room temperature and elevated temperatures. An increase in strength is observed with 30 vol. % SiC particles at room temperature.



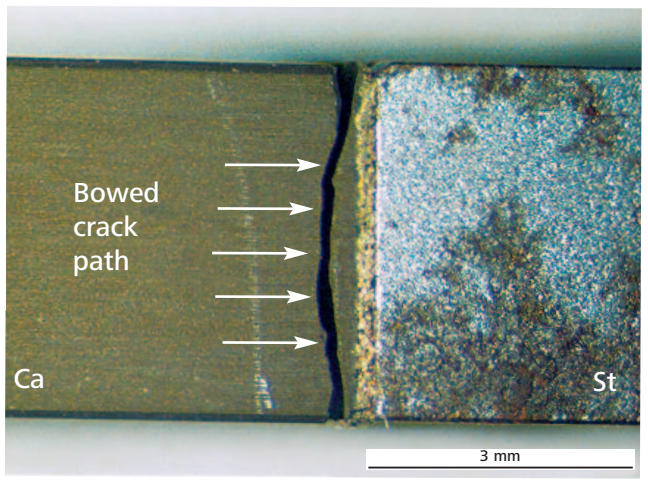


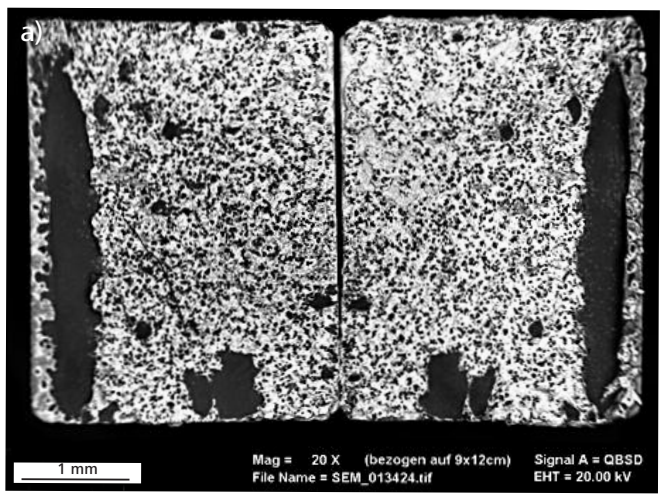
a) SEM of a ceramic-to-steel joint brazed with Incusil ABA + 30 vol.% SiC (sandwich system) shows a homogeneous distribution of SiC particles (black) in the centre of the braze gap ~300 mm thick; b) high magnification of a SiC particle shows a 200 nm thick Ti rich reaction layer on the SiC particle.

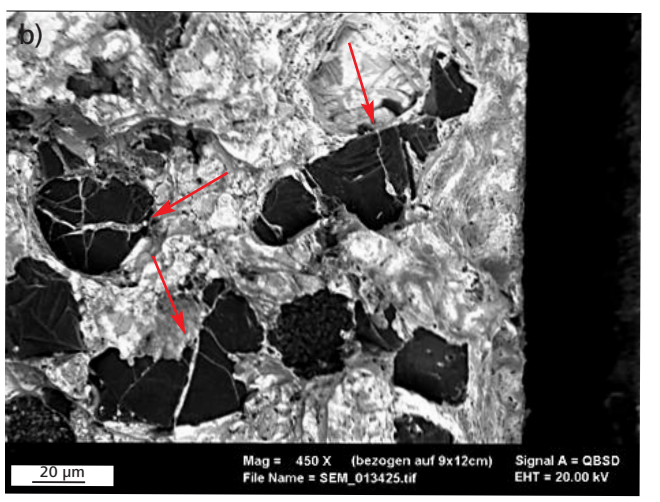




Low strength samples fail through the ceramic. High strength joins fail through the braze and the braze/ceramic interface. In high strength joins, cracks also go through the reinforcing SiC particles.







* jakob.kuebler@empa.ch
[1] Empa Swiss Federal Laboratories for Materials Science and Technology, Laboratory for High Performance Ceramics, Ueberlandstrasse 129, 8600 Duebendorf, Switzerland.
[2] Empa Swiss Federal Laboratories for Materials Science and Technology, Laboratory for Joining and Interface Technology, Ueberlandstrasse 129, CH-8600 Duebendorf, Switzerland.