

Thermal Fatigue Behaviour of SiC_p/Al Composite Synthesized by Metal Infiltration

C. M. Lawrence Wu^{1,3} and G. W. Han^{1,2}

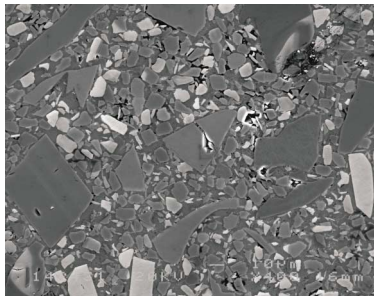
¹Dept. of Physics and Materials Science, City University of Hong Kong, Hong Kong SAR, P.R. China

²Dept. of High Temperature Mater. Res., Central Iron & Steel Research Institute, Beijing 100081, P.R. China

³Corresponding author, Fax. (852) 27887830, e-mail: Lawrence.Wu@cityu.edu.hk

Objectives

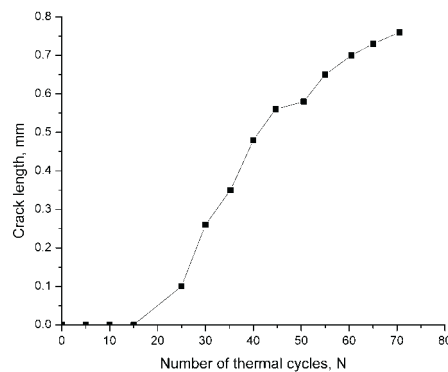
- Synthesize SiC_p/Al composite by infiltration of molten aluminium alloy into a preform of 65vol% SiC_p.
- Study the crack propagation and fracture surface characteristics of SiC_p/Al composite under thermal fatigue.
- Study for the crack propagation and fracture surface characteristics.



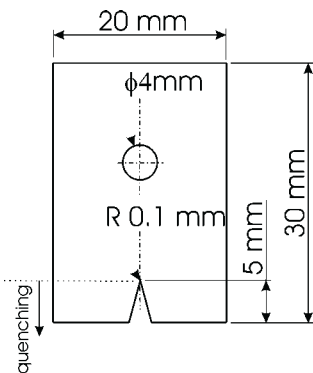
The microstructure of the composite, showing the use of large (35vol%) and small reinforcing particles to achieve overall high volume fraction of reinforcing particles.

Major findings:

- With a thermal fatigue specimen containing a V-shaped notch, crack initiation at the notch tip commenced after 15 cycles of thermal shock, produced by quenching in water from 300deg C.
- The study of the fracture surface revealed that thermal fatigue crack initiation and propagation was facilitated by mainly fracturing the large reinforcing particles in the composite.
- By reducing the size of the reinforcing particles would increase the resistance of this kind of composite against thermal fatigue.

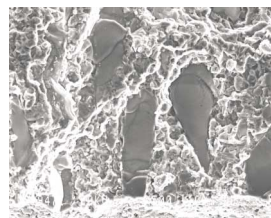


Critical number of thermal cycles is about 15. The initial fairly linear growth of crack length with the number of thermal cycles slowed down at high number of thermal cycles.

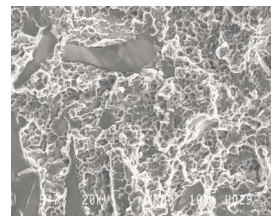


Thermal fatigue specimen

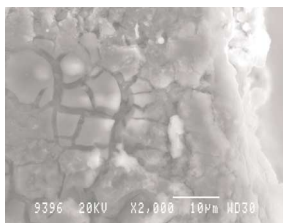
Fracture surface analysis



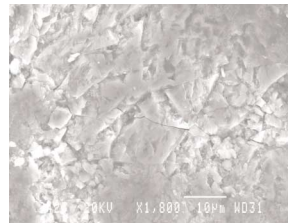
Fracture near notch tip: large particles are clearly seen to be fractured.



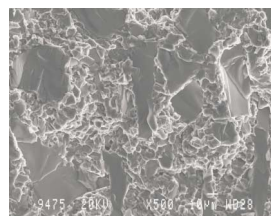
Fracture at crack propagation area: large particles were also fractured.



Crack initiation area at which large reinforcing particles were fractured.



Crack propagation through the composite; many large reinforcing particles were fractured.



Fracture of impact failure sample: large particles are fractured, with evidence of cleavage.