The Effect of Sintering Additives on the Mechanical, Oxidation and Electrical Properties of $Si_3N_4/MoSi_2$ Composites

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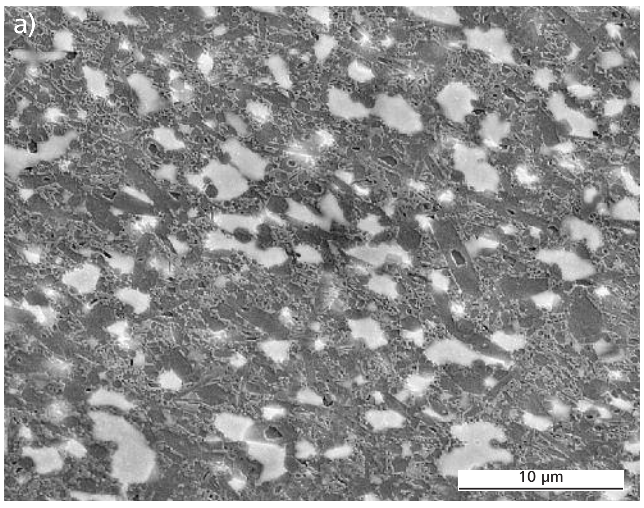
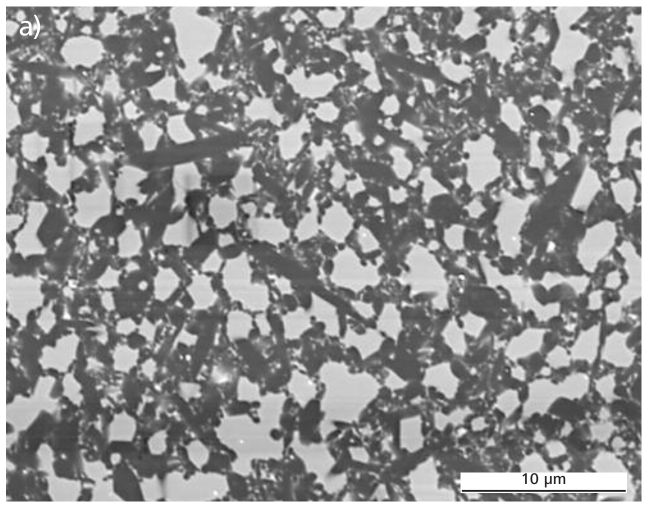
Microstructure and properties of electrically conductive Si_3N_4–$MoSi_2$ composites using different sintering additive systems [a) YAG ; b) LuO_2]) were investigated. $MoSi_2$ (white grains) reacted with N_2 atmosphere during sintering resulting in the formation of Mo_5Si_3.

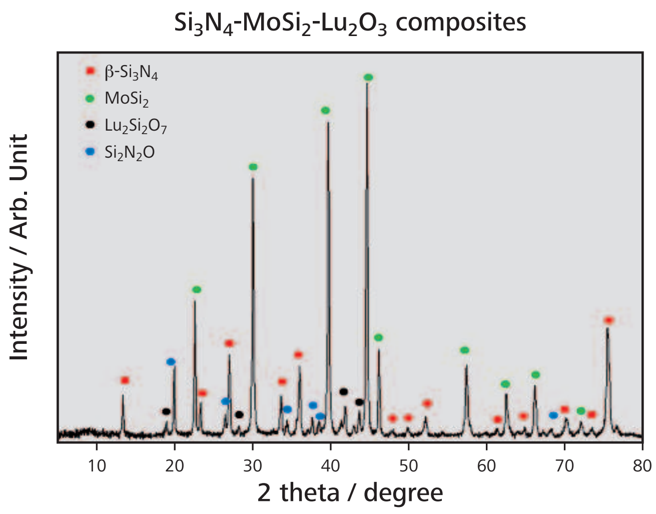


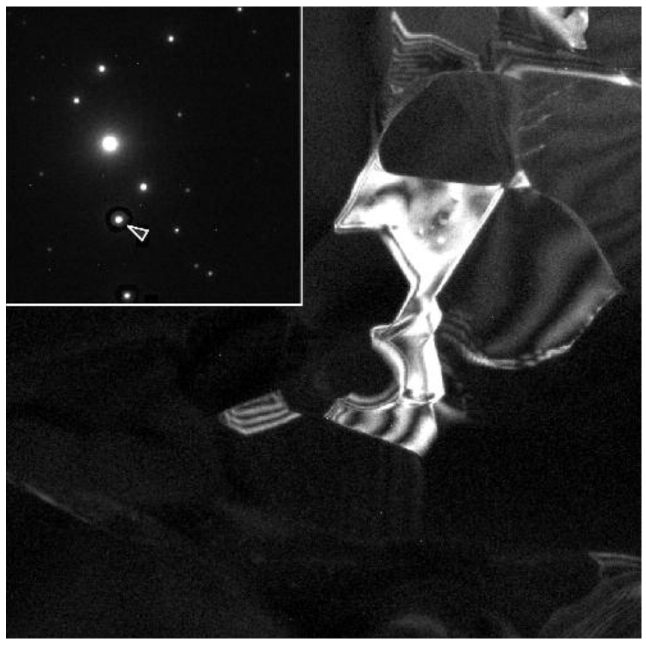
Sintered in Nitrogen



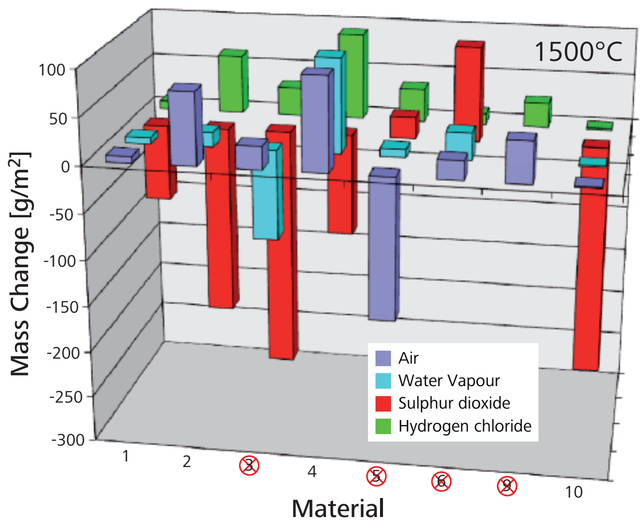
Sintered in Argon

Composites doped with Y_2O_3-Al_2O_3 had an amorphous grain boundary phase, while the grain boundary phase of the Lu_2O_3-doped composites was completely crystallized into $Lu_2Si_2O_7$.





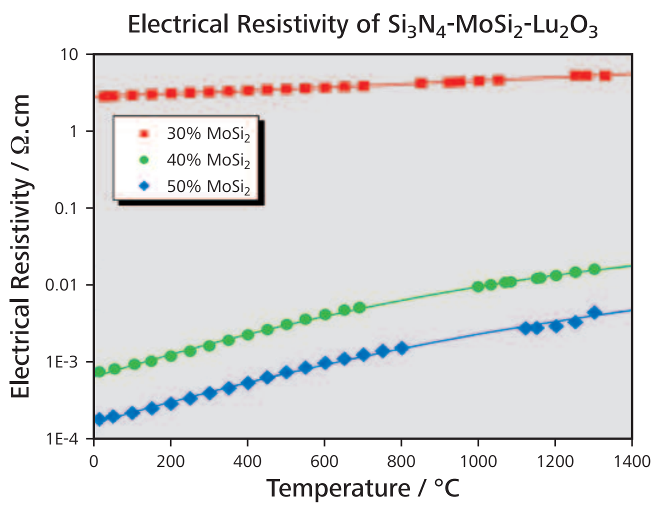
Lu_2O_3-doped composites had superior oxidation resistance compared to the composites containing Y_2O_3-Al_2O_3. Parabolic oxidation kinetics were observed in the composites with both types of additives.

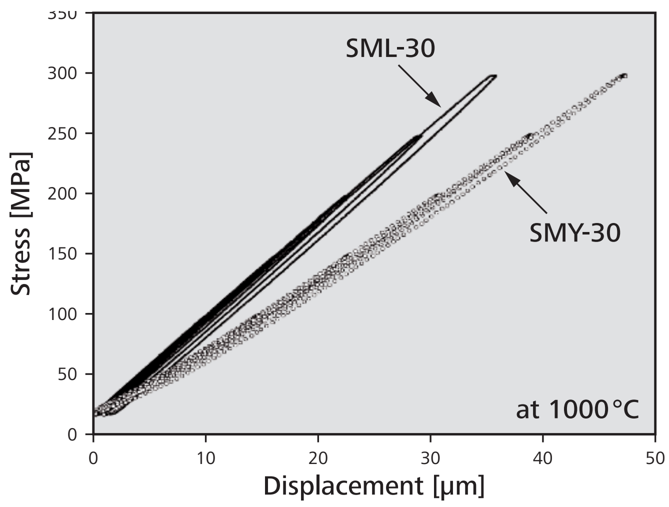


1) Si_3N_4 +Al_2O_3
2) Si_3N_4+Al_2O_3+Y_2O_3
3) Si_3N_4+HgO
4) Si_3N_4+Y_2O_3
5) Si_3N_4-$MoSi_2$+Al_2O_3+Y_2O_3
6) Si_3N_4-$MoSi_2$+MgO
9) Si_3N_4-TiN+Al_2O_3+Y_2O_3
10) Si_3N_4+Lu_2O_3

⊗ failed before reaching 128 h

(Metallic-like) electrical conductivity of the composites exhibited typical percolation type behaviour. Composite containing Lu_2O_3 (SML-30) had a higher elastic modulus and better creep resistance at elevated temperatures than the one doped with Y_2O_3-Al_2O_3 (SMY-30). Toughness and strength were not influenced significantly by the grain boundary phase.





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