High Temperature Properties of SiAlON

Dilek Turan[2], Alper Uludag [2] Yağmur Deniz[3], Sinem Baskut, Serkan Ulukut[4], Ferhat Kara[1] and Servet Turan [1]

[1]Department of Materials Science and Engineering, Eskisehir Technical University, 26480, Eskisehir, Turkey

[2]Department of Airframe and Powerplant Maintenance, Eskisehir Technical University, 26480, Eskisehir, Turkey

[3]Department of Metallurgical and Metarials Engineering, Pamukkale University 20160, Denizli, Turkey

[4]TEI-TUSAŞ Engine Industries Inc, 26210, Eskişehir, Turkey

Silicon nitride (Si_3N_4) and its solid solutions (SiAlONs) are widely used ceramics for structural applications due to their exceptionally good physical and mechanical properties, such as high wear, hardness and creep resistance. The service life of Si_3N_4 and SiAlON materials at a high temperature under stress is limited by deformation over time, which is termed creep. Because of their highy covalent Si-N bonds and low diffusion coefficients, sintered silicon nitrides are usually densified with the aid of additives which form a liquid phase at the sintering temperature promoting solid transport by the liquid phase sintering mechanism. Unfortunately, on cooling, the liquid generally transforms into a residual intergranular amorphous phase whose quantity, distrubution and chemical composition control the mechanical properties at high temperature. In order to minimize the amount of vitreous phase, several techniques have been tested such as crystallization heat treatments which improve the creep resistance by limiting the viscous flow in the recrrytallized phases. In this study, different heat treatments (AET, BET), different second phase additions (SiC), different additives (Er, Yb and Lu oxides) were used to improve creep properties of SiAlON ceramics. The creep results will be explained in terms of microstructure.