DEVELOPMENT OF OXIDE-BASED CMCS WITH HIGH THERMAL STABILITY

Isao Yamashita, Advanced Materials Research Laboratory, Tosoh Corporation, Japan
isao-yamashita-pu@tosoh.co.jp
Yushi Nawata, Advanced Materials Research Laboratory, Tosoh Corporation, Japan
Ikuya Ohta, Advanced Materials Research Laboratory, Tosoh Corporation, Japan
Yo Hirataka, Advanced Materials Research Laboratory, Tosoh Corporation, Japan

Key Words: oxide, CMCs, thermal stability, thermal exposures

Novel oxide-based CMCs with high thermal stability was developed with new approach for improving thermal stability of ceramic fiber. The approach is based on suppression of grain growth of oxide ceramic fiber (alumina and mullite) during thermal exposure. We have developed uniform doping method of grain growth inhibitor element for ceramic fiber. Figure 1 shows relative single filament tensile strength (modified/non-modified) after thermal exposure at 1300°C-100h. Single filament tensile strength test (JIS R 1657) shows that the modified fibers improve fiber strength after thermal exposure. Scanning Electron Microscope (SEM) observation also shows suppression of abnormal grain growth for modified fiber (Fig.2). CMCs was fabricated by slurry infiltrations method using alumina based matrix. Table 1 shows a mechanical properties of CMCs (0°/90° woven piles) using the fibers based on ASTM C1275. Thermal exposure test was conducted using rectangle shape sample (length 110 mm, width 10 mm, thickness 2 mm) at 1200°C-1000h in air. No remarkable reduction of retention rate was observed on alumina and mullite fiber based CMCs. Thermal exposure test shows high thermal stability for CMCs with modified oxide ceramic fiber.

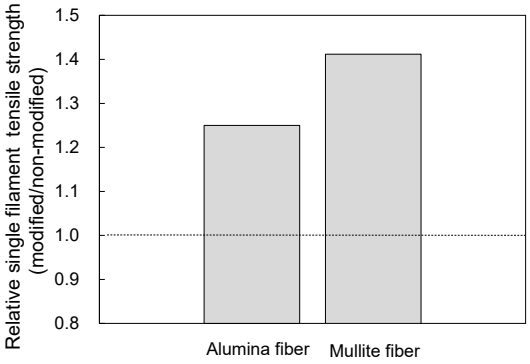

Figure 1 – Relative single filament tensile strength after thermal exposure at 1300°C-100h.

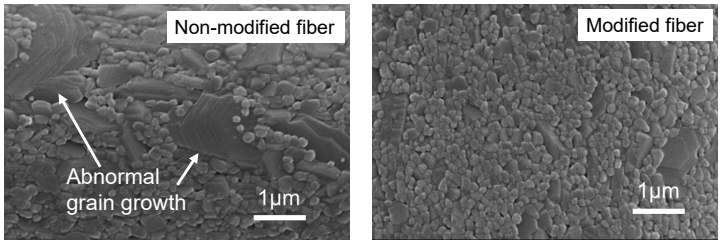

Figure 2 – SEM image of surface of alumina fiber after thermal exposure at 1300°C-100h.

Table 1 Mechanical properties of novel oxide-based CMCs with modified ceramic fiber.

CMCs	Density (g/cm^3)	Young`s modulus[1)] (GPa)	Proportional limit[1)2)] (MPa)	Tensile strength[1)] (MPa)	Thermal stability[3)] (%)
Modified alumina fiber-based CMCs	2.75	73	290	295	97
Modified mullite fiber-based CMCs	2.62	64	140	183	106

1) Following ASTM C1275, 2)0.05% Offset Method, 3) Retention rate of tensile strength after 1200°C-1000h