The Development of *In Situ* High Temperature Transmission Electron Microscopy for Heat-Resistant Ceramics

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One of essential processes of the development in advanced materials is to analyse dynamics of microstructure at actual environment of usage. We have developed in situ high temperature transmission electron microscopy (TEM) because the method can provide all the kinds of the information of high temperature dynamics of microstructures of various heat-resistant materials. We have already developed a new type of a 2000 K class high temperature stage for TEM of various shaped materials, as reported in the 2nd Symposium on SIP-IMASM 2016 [1, 2]. In this study, we report one of the applications of the in situ high temperature TEM to thermal barrier ceramics coating used in advanced jet engines.

Master samples of thermal barrier ceramics coating were cut and milled mechanically to observe the interface cross section of the coating and were thinned using an ion beam focused method. The sample was sandwiched by an originally designed mesh heater. The heater containing the sample was mounted on the sample holder for the \textit{in situ} high temperature TEM (JEOL JEM-2011KZ-Custom) [3–5].


Schematic of the \textit{in situ} high-temperature TEM of thermal barrier ceramics coating.
During the heating process, the structural dynamics of the variation of the texture was observed in situ by lattice imaging of high-resolution TEM using a video capture system.

We could successfully observe the fracture process of the thermal barrier ceramics coating and confirm that the method enables the investigation of high temperature dynamics of the coating texture of heat-resistant ceramics at the atomic scale.

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