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P2.194 Comparative study of thermal and microstructural properties of tungsten for the application to PFM

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Tungsten is to be used as plasma facing material of divertor target for ITER. Though the present ITER specification for divertor target requires pure tungsten as a plasma facing materials, much research effort is being devoted to improve the material properties of tungsten for the application to severe conditions predicted in DEMO reactor. Among the material properties of tungsten, thermal conductivity is of primary importance in estimating the thermal response and stability of high heat flux component. While various methods are applied to improve the mechanical properties of tungsten, we should assess the thermal conduction of the materials and the resultant performance as a HHF component.
In this study, we investigated thermal and microstructural properties of pure and dispersion strengthened tungsten fabricated by Spark Plasma Sintering (SPS) method in comparison to the tungsten materials produced by different suppliers. We measured the thermal conductivity of the examined materials and compared them with chemical composition, density and microstructure of the samples. Thermal conductivity up to 900℃ was derived from thermal diffusivity and specific heat measurement by laser flash method. And chemical composition was analyzed through glow discharge mass spectroscopy. Thermal conductivity values show a close correlation with content of compositional element, on the other hand, Vickers hardness shows correlation with the average grain size of the samples. The sample produced by different fabrication process shows different density and thermal conductivity. While TiC-added tungsten fabricated by SPS method shows improved stability in microstructure against recrystallization after exposure to high heat flux, the reduction of thermal conductivity is analyzed in comparison to the amount of contained additive elements. In addition, we compared thermal conductance behavior through plasma facing component in high heat loading experiment with respect to measured thermal conductivity variation.

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