Development of Si-W Transient Tolerant Plasma Facing Material

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Abstract. Solid W is projected as the preferred plasma facing material. Unfortunately, W surfaces could suffer radiation damage under DT operation and will melt under Type-I edge localized modes and disruption events. A possible approach is the use of a low-Z sacrificial material, like Si deposited on the W-surface to withstand a few type-I ELMs and/or disruptions via the vapor shielding effect. Accordingly, sets of Si-W test buttons were fabricated and exposed in the DIII-D lower divertor. We found that when the Si-W buttons were exposed to a few DIII-D vertical displacement event disruptions, tungsten-silicide was formed which melts at 1414°C. This clearly indicates that the Si-W combination cannot be used as a transient tolerance surface material, since the W surface can be damaged. Even when Si is used as a wall conditioning material the Si-W surface temperature should be operated at much lower than 1400°C.

PACS: 52.40.Hf, Plasma-material interactions