MEASUREMENT OF LOW ENERGY SPUTTERING OF HIGH TEMPERATURE LIQUID TIN FOR DIVERTOR APPLICATIONS

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The sputtering yield of liquid Sn under low energy ion bombardment has been previously shown to have slight temperature dependence when increasing the sample temperature from room temperature to 400ºC [1]. Extension of these measurements to 1200ºC – the estimated evaporation-limited temperature limit [2] -- is needed to evaluate liquid Sn as a flowing divertor surface material. The Ion-surface InterAction eXperiment (IIAX) uses a velocity and neutral filtered low energy (< 2000 eV) ion beam to bombard sample materials and monitors the response, typically in the form of sputtering yields. The experiments reported here extended the temperature range to 1000ºC to evaluate the strength of the temperature-dependence in the temperature range of interest for a flowing liquid tin divertor. Such a divertor would allow rapid removal of heat and have a self-healing nature. Thus, a flowing liquid tin divertor would not have to be replaced as expected for any solid divertor in next-generation, high duty cycle, high power density fusion machines. Since another candidate for a flowing liquid metal divertor surface, lithium, has shown strong temperature dependence in its sputtering yield [3, 4], similar studies must be performed for liquid Sn to determine if it is a viable candidate. While the main constraint upon the use of flowing liquid Sn as a divertor surface is self-sputtering [2], greatly-enhanced light ion sputtering at higher temperatures may also prevent its candidacy.

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