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Evolution of Elemental Composition and Morphology in Fusion Reactor's First Wall YONG W. KIM, Lehigh University — Forcing of a multi-element alloy by a gradient field can modify the spatial profile of its elemental composition. The gradient field may be in the imposed temperature or the flux of impinging particles. In a fusion device, both scenarios apply. The consequences must be well understood because they change the thermal transport properties as well as the strength, corrosion and wear characteristics of the first wall materials. Given the large number of directions material evolution can take, new robust methods of near-surface composition analyses are needed. This paper presents a new measurement methodology and requisite instrumentation, which can provide measures of local elemental composition and transport properties simultaneously by time-resolved spectroscopy of laser-produced plasma (LPP) plume emissions from the specimen surfaces. The studies to date show that the composition profiles can be modified thermally in a reproducible manner; disparate thermal transport of constituent atoms can incur modifications of near-surface composition profiles.[Y.W. Kim, Int. J. Thermophysics ***28,*** 732 (2007)] Also, disparate fluxes of fuel particles, fusion products and impurities force the first walls in myriad ways. Repetitive application of the LPP analysis can resolve the near-surface composition profile as well as transport properties over several microns with depth resolutions to 20 nm. Work supported in part by NSF-DMR.

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