

IN-SITU MEASUREMENTS OF GROWTH STRESSES IN ALUMINA FILMS USING SYNCHROTRON RADIATION

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Abstract

While growth stresses in oxide films formed by high-temperature oxidation have long been discussed and modeled, there has been considerable disagreement regarding their magnitude and importance relative to the stresses generated during temperature changes by the differences in the coefficients of thermal expansion between the substrate and oxide product. This paper describes the initial results from the use of focused monochromatic synchrotron radiation to measure stresses in growing alumina films during high-temperature air exposures of Fe- and Ni-based alloys at temperatures in excess of 1000°C. The excellent time resolution afforded by the use of synchrotron undulator radiation to measure strains in the oxide revealed, in some cases, rapid changes in stress caused by film growth and relaxation processes

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