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Chromium Volatility: Assessment of Quantifying Techniques

Chromium volatility is a phenomenon with significant implications in any process that involves flowing a gaseous stream over a Cr-containing solid (e.g., stainless steel) sample at high temperatures. The chromium present within the steel substrate has been observed to migrate into the surface oxide scale that forms during exposure and subsequently vaporizes off the oxide surface as chromium-containing vapor species. In fuel cell environments, the vaporized chromium species could interact with the cathode forming non-conducting species and would be deleterious to the cell function. The primary objective of this University Scholars Program (USP) project is to research and explore chromium volatility as well as the techniques available to quantitatively measure and account for the chromium lost from a steel sample in the hopes that once the chromium evaporating from a metal surface can be calculated, materials can then be developed to reduce this chromium evaporation and lengthen cell lifetime. Two techniques, Rutherford Backscattering Spectroscopy (RBS) and the Transpiration method are applied to quantify vaporized chromium and compared and the relative advantages and disadvantages of both techniques are evaluated. The anticipated significance of the project will be contribution to ongoing research aimed at combating a reoccurring problem observed in industry.