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High-Throughput Aqueous Passivation Behavior of Thin-Film *vs.* Bulk Multi-Principal Element Alloys in Sulfuric Acid

M.L. Taheri (JHU), J.R. Scully (U. Virginia), and K. Sieradzki (ASU)

Multi-principal element alloys have the potential to show excellent passivation behavior. Identification of promising compositions often relies on a combinatorial library (CL) alloy wafer approach, but the validity of results from such films in predicting bulk alloy performance is unknown.

In this work, 177 alloy spots from a CL with varying composition and structure were studied. Bulk samples of $(FeCoNi)_{1-x-y}Cr_xAl_y$ were prepared and processed at PARADIM using unique capabilities of its ancillary synthesis facility, including oxygen free arc melting and water jet cutting capabilities to enable quantitative comparisons with the CL spots. Due to varying grain size and the grain boundary dissolution a one-to-one correlation could not be made useful between thin films and bulk. However thin-films of varying composition can be compared relative to one another in terms of common passivation metrics (such as E_{corr}, i_{crit}, i_{pass}, $|Z|$, etc.) across a CL wafer and that this trend in behavior can be used to predict the likely best bulk sample composition(s) for passivation performance.

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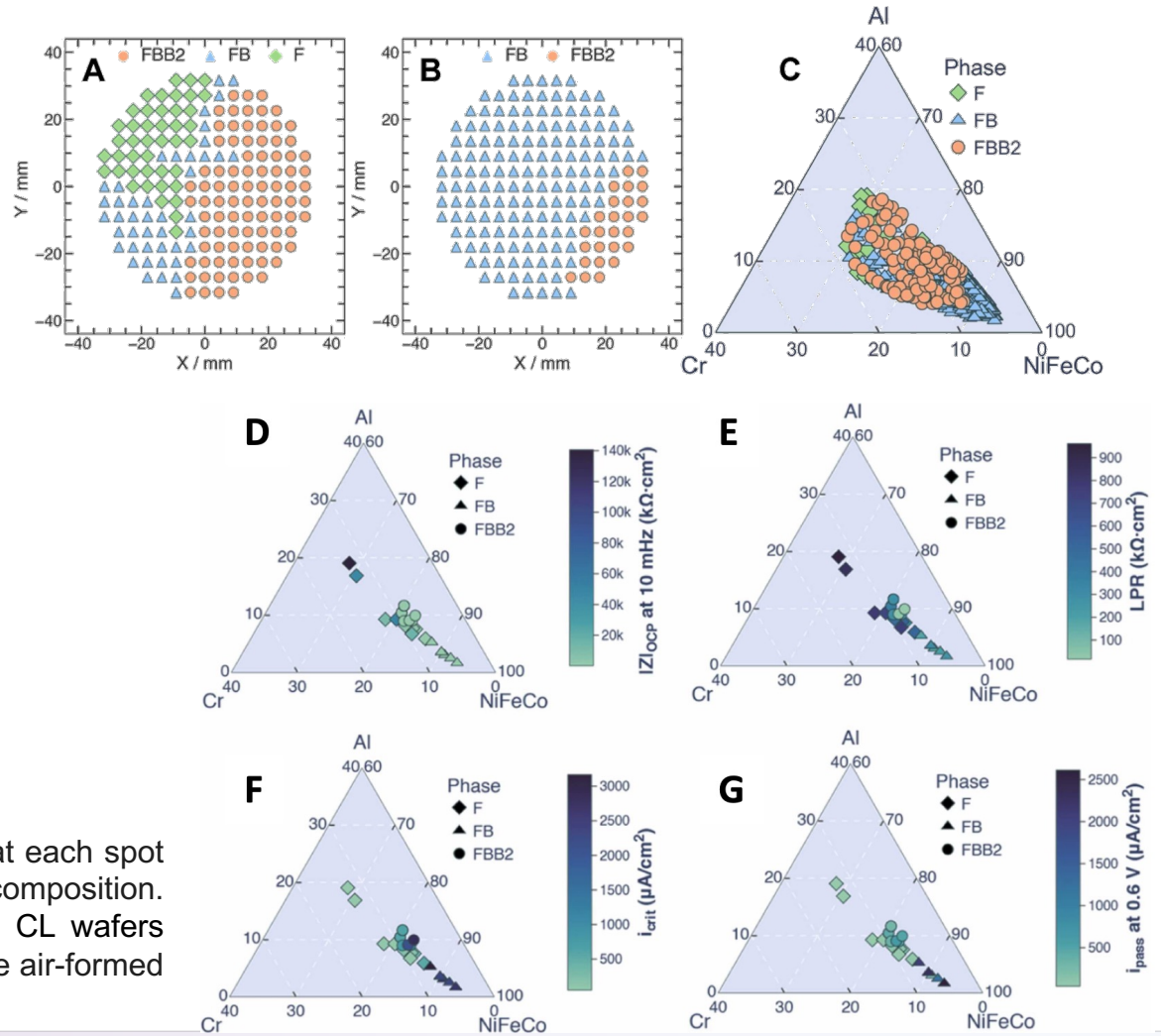

Figure: Compositions and crystal structures of the combinatorial library wafers. (**A**, **B**) XRD at each spot on the wafers was measured. (**C**) Pseudo-ternary phase diagram of all spots as a function of composition. (**D**-**G**) Scanning droplet cell results of the aqueous electrochemical measurements on the CL wafers plotted on the pseudo-ternary phase diagrams, $|Z|_{OCP}$ (D), LPR measured after reduction of the air-formed oxide (E), critical current density for passivation (F), passive current density, i_{pass} at 0.6 V (G).