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Novel Electrocatalysts Prepared by Soft Landing of Mass-Selected Cluster Ions GRANT JOHNSON, TREVOR MOSER, NIGEL BROWNING, MARK ENGELHARD, JULIA LASKIN, Pacific Northwest National Laboratory — Metal clusters, which possess size and composition dependent properties, are promising materials for use as catalysts to promote electrochemical reactions in fuel cells. A physical synthesis technique, magnetron sputtering combined with gas-aggregation, has been employed to produce anionic metal clusters in the gas-phase across a range of sizes, shapes, and compositions for mass-selection and deposition onto glassy carbon electrodes. Sputtering of multiple targets in the same region of gas aggregation is demonstrated to produce uncapped binary and ternary alloy clusters with defined composition and morphology that are not accessible through synthesis in solution. Introduction of reactive gases including alcohols, alkanes, and amines into the sputtering region is shown to result in the formation of complex cluster morphologies containing carbon, nitrogen, and oxygen. A suite of cutting-edge characterization techniques is utilized to demonstrate how the size, shape, elemental composition, and surface density of clusters may be tuned through variations in source parameters such as the sputtering power, gas flow rates, and aggregation distance. The catalytic activity of the soft landed clusters towards the oxygen reduction reaction, a critical process occurring in hydrogen fuel cells, is measured using cyclic voltammetry. Alloy clusters containing reduced quantities of precious metals are shown to exhibit promising catalytic activity.

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