Modified carbon aerogels for electrocatalysis

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Carbon aerogels constitute a new family of porous carbons with numerous beneficial properties. For more than two decades sol-gel techniques have been employed to prepare polymer aerogels with tailored structure, which are excellent precursors for porous carbon. Resorcinol (R) and formaldehyde (F) have been the most widely used monomers. Sol-gel techniques have been applied to prepare polymer aerogels of tailored structure, which are excellent precursors for porous carbon. Due to the flexibility of this synthesis route heteroatoms (e.g. nitrogen, phosphor, sulphur, metals) or nanoparticles can be easily incorporated into the carbon matrix.
In this work nitrogen doped carbon aerogel - graphene composite materials were prepared from resorcinol (R) – melamine (M) – formaldehyde (F) copolymers. Graphene was incorporated as graphene-oxide suspension during the polymerization process.
Nitrogen is the most versatile heteroatom in carbon matrices. It affects both the physical and the chemical behaviour of carbons already at low concentration (<1.5%) by influencing the electron distribution and thus the electrical, hydrophilic/hydrophobic and catalytic properties. Nitrogen doped carbon materials have a great potential in energy conversation and storage e.g., as catalyst in the oxygen reduction reaction (ORR) of fuel cells. The electrical conductivity of the carbon materials is crucial in these applications. Incorporation of graphene into the porous carbon matrix can further improve the electrical conductivity without deteriorating their beneficial properties.
The morphology of the carbon aerogels obtained was characterized by low temperature nitrogen adsorption/desorption isotherms and scanning electron microscopy (SEM). The surface chemical composition was determined by X-ray photoelectron spectroscopy (XPS). The catalytic performance in ORR was followed by cyclic and linear sweep voltammetry (CV, LSV).
Samples prepared without melamine were used for comparison.

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