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Understanding Pore Connectivity in Hard-Templated Carbon Materials

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Following the need for clean energy transit and lowering carbon emissions, many electrochemical devices have been put out as energy storage tools such as fuel cells, batteries, supercapacitors, etc. all these applications require electrodes with high surface area, good flow, and mass transport hosts active material and releases bubbles. For these properties, we introduce porosity into our electrodes. However, what is important in porosity, how can we control it, and which properties are critical for catalytic purposes?
Pore Connectivity is a critical aspect in templated carbons that is usually dismissed or overdone, adding more template and connecting the nodes in the system shows percolation behavior in porosity, as properties grow after the percolation threshold where connectivity is satisfied. In this work, we analyzed two carbons (PAN and glucose) produced through a hard template synthesis (zinc oxide and silica) with a changing template ratio to understand the way the pore architecture is molded and formed. Using N2 BET adsorption, Computational simulations, and different electrochemical measurements. we report the findings that porosity produced via hard templated carbons behaves as a step function and so do many other properties which are derived from the surface area change.
We observed many properties of these hard-templated carbons acting as a percolation phenomenon (step function behavior). For ZnO templated PAN carbons plotting the SSA and ECSA as a function of template ratio generated a percolation (step-function) type behavior, this was also seen in other measurements with, RDE measurements, as well as computational calculation of the surface area producing the same phenomenon and confirming even further the percolation effect in connectivity.

Participation

In-Person

References

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