Structure of Boron-Based Catalysts from ^{11}B Solid-State NMR at 35.2T

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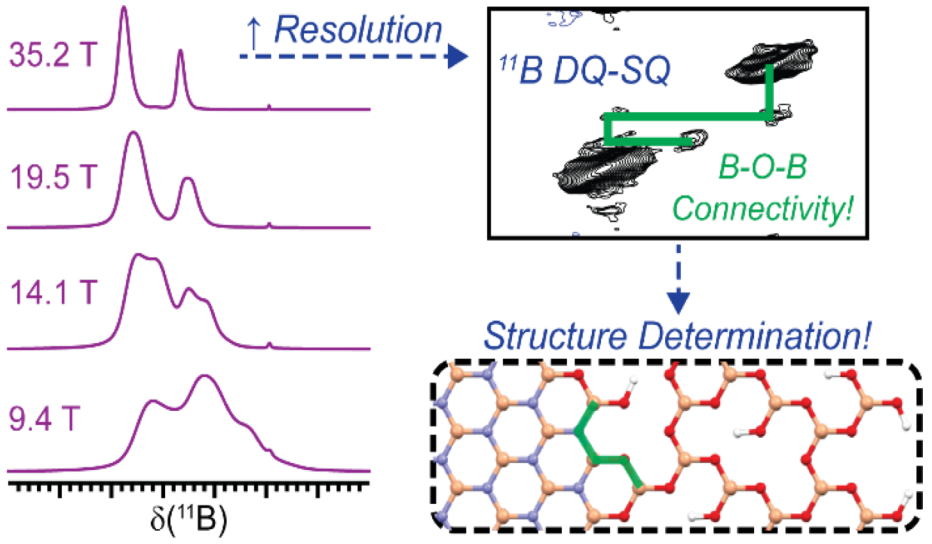
Boron-based oxidative dehydrogenation catalysts, such as hexagonal boron nitride *(h*-BN) and silica-supported boron oxides, are highly selective catalysts for the oxidative dehydrogenation (ODH) of light alkanes to olefins. Light olefins, such as propylene, are critical chemical feedstocks. *The identification of molecular structure of the active sites in catalysts is crucial for the rational design and development of improved ODH catalysts*.

MagLab users from Iowa State University and the U.S. DOE Ames Laboratory use high-field solid-state nuclear magnetic resonance (NMR) of boron to characterize boron-based catalysts. Boron-11 (^{11}B) NMR is potentially an ideal technique to determine structure within boron-based materials because it is sensitive to the local chemical environment and the symmetry surrounding the nucleus. However, it can be challenging to identify all of the ^{11}B NMR signals, because they often overlap due to quadrupolar broadening. *The MagLab's 35.2T Series-Connected Hybrid resolves the ^{11}B NMR lines, enabling the identification of structure within h-BN and silica-supported boron oxide ODH catalysts (featuring only 1wt.% boron) by recording two-dimensional ^{11}B homonuclear correlation spectra to determine structure in the catalyst*. These studies are infeasible in lower-field, conventional NMR magnets.



(Left) *The MagLab's 35.2T Series-Connected Hybrid Magnet dramatically enhances ^{11}B NMR spectral resolution beyond that of any other spectrometer in the world*.

(Right Top) The Series-Connected Hybrid enables high resolution two-dimensional ^{11}B homonuclear correlation spectra, from which (Right Bottom) the identification of structure within *h*-BN and silica-supported boron oxide ODH catalysts can be determined.

Facilities and instrumentation used: NMR/MRI, 36T SCH.

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