

Introduction:

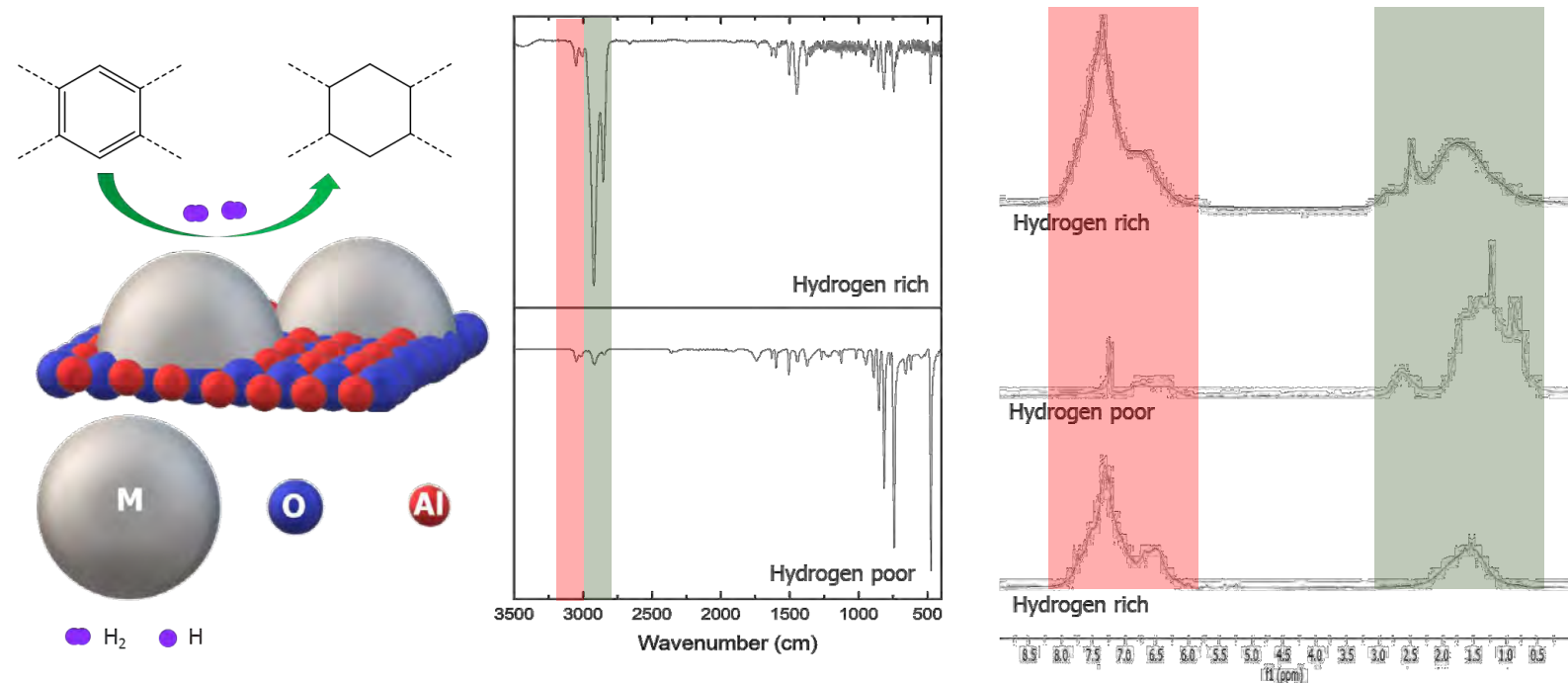
The high safety risks associated with hydrogen gas leakage have led to the development of solid-state hydrogen carriers as alternative storage systems. Hydrogenated organic compounds have been investigated for their ability to securely store hydrogen through chemical bonding. Recently, novel polymers have been designed with specific pendant groups that can readily absorb hydrogen through covalent bonds. By subjecting the polymer to hydrogen in the presence of a catalyst and elevated temperatures, these bonds are formed. The objective of this research is to create a safe and efficient polymer-based hydrogen carrier with high capacity, suitable for various applications such as vehicles fuel. These innovative polymers offer a sustainable and cost-effective solution, contributing to a greener and more sustainable future.¹

Experiment:

Here, polymers with aromatic pendant groups are employed as solid-state hydrogen carriers, storing hydrogen through chemical bonding. The polymer solution is hydrogenated using a high-pressure autoclave under different conditions, leading to form stable covalent bonds.

Results:

The FTIR and HNMR results of hydrogenated and dehydrogenate polymer represents the possibility to reversibly transform from hydrogen poor to hydrogen rich polymers. By comparing the aromatic picks (red box) and aliphatic peaks (green box) the transformation can be approved.



Scheme: The structure of hydrogenation reaction in presence of metal based catalyst

Figure: The FTIR (left) and the ¹H NMR (right) spectrum of hydrogen rich and hydrogen poor polymers.

Conclusion:

The approval of using polymers with aromatic pendent groups for mobile applications has provided promising results for the solid-state hydrogen carrier. These polymers have demonstrated the potential to offer the high hydrogen capacity required according to the DOE standard.

Reference:

M. Sharifian, W. Kern, and G. Riess, *Polymers* 2022, 14, 4512, doi: 10.3390/polym14214512.