Revealing new applications for carbon nanomaterials in hydrogen storage

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An international research team, involving Professor Rajeev Ahuja at Uppsala University and researchers in the USA, set out to understand the mechanism behind the catalytic effects of carbon nanomaterials. Experimental and theoretical efforts were combined in a synergistic approach and the results, published this week in the ASAP section of the journal *Nano Letters*, will fasten efforts to develop new catalysts.

Our energy-hungry world has become increasingly dependent on new methods to store and convert energy for new, environmentally friendly modes of transportation and electrical energy generation as well as for portable electronics. Mobility — the transport of people and goods — is a socioeconomic reality that will surely increase in the coming years. Hydrogen, which can be produced with little or no harmful emissions, has been projected as a long term solution for a secure energy future. Research into safe and efficient means of hydrogen production, storage, and use is essential to make the "hydrogen economy" a reality.

Car manufactures are showing interest in using solid state hydrogen storage materials, e.g. $NaAlH_4$, as new energy storage media. The functional properties of these materials however have to be improved by catalysts. The effect of earlier catalysts, e.g. Ti, has been difficult to explain. The current results give an unambiguous understanding of the mechanism at work in the new carbon nanomaterial catalysts.

The researchers set out to understand the mechanism behind the catalytic effects of carbon nanomaterials, specifically on the example of sodium

alanate, which is a popular material for hydrogen storage studies.

"Now that the catalytic capabilities of carbon nanomaterials have been demonstrated so clearly and the mechanism that makes this behaviour possible has been understood, we expect a strong impulse on putting this effect to use in practical applications.", says Professor Rajeev Ahuja.

"Certainly, our findings have the strongest impact in the field of hydrogen storage, but beyond that, the same mechanism that we revealed can make carbon nanomaterials a very important catalyst in many other systems as well."

The extensive simulations were performed at Uppsala University's Multidisciplinary Center for Advanced Computational Science (UPPMAX).

Source: Uppsala University