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A study of carbon-hydrogen bond on the nanostructured ball-milled graphite for hydrogen sensor

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With the development of fuel cell technologies, the detection of flammable gases such as hydrogen is an important safety issue. As a promising hydrogen sensor, milled graphite could be absorb a large amount of hydrogen. However, there is a need to understand the hydrogen sorption mechanism(s). In this work, hydrogenated graphite samples were characterized by TGA-Mass Spectrometry, Raman spectros-copy and high resolution TEM. It was found that graphite milled for various times (0-40 h) had different d-spacings and CH_x ($x \leqslant 3$) ratios. Graphite milled up to 10 h that was subsequently heated (under argon to 990 ° C) desorbed only hydrogen, while above 10 h the amount of desorbed hydrogen decreased and an increasing amount of methane was also evolved. The 10 h sample had no measurable sp3 bonding, and desorbed 5.5 wt% hydrogen when heated. While the 40 h sample had a d-spacing of 0.48 nm, both sp2 and sp3 bonding, and desorbed 5.1 wt% pure hydrogen. The mechanism of graphite hydrogenation is discussed in terms of hydrogen atoms being predominately trapped at the graphite edges, rather than between graphene layers.

References

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