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2Mechanism of ferromagnetism occurring in CVD-adamantane films

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Recently there have been reports of room-temperature ferromagnetism induced in carbon compounds, including "Teflon"sheets and "Q-carbon". In this work, we would like to create room-temperature ferromagnetism with the 1-cage from adamantane; the smallest member of the material called "diamondoid"series (nano-diamond structures). By using chemical vapor deposition (CVD), we prepared the films on various substrates, e.g. Si, quartz and sapphire. Intriguingly, we found the signature of moderately strong ferromagnetism with saturated magnetization up to 120 emu/cm^3. By using XPS and EDS, we have found no trace of any magnetic elements, e.g. Fe, Co, and Ni. The Raman spectra display forms of carbon bondings occurring in the film surface, including sp^2, sp^3 and C-H. Furthermore, NMR spectra show that chemical bonding of the substrate have changed during the CVD process. These suggest that carbon atoms of adamantane molecules are largely decomposed to other forms with non-sp^3 bondings. The origin of this ferromagnetism, including dangling bond (which is suggested to be the cause of ferromagnetism in Teflon sheets) and a single π-state coupling (which is reported to be cause of ferromagnetism in isolated hydrogen atom absorbed on graphene), will be discussed.

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