Specific heat of rhombohedral C\textsubscript{60} polymer in the temperature range of 2-300K

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Under high temperature of 700K and high pressure of 6 GPa, we have prepared a batch of C\textsubscript{60} polymer. XRD data confirmed it is rhombohedral phase and solid \textsuperscript{13}C NMR showed a formation of sp\textsuperscript{3} bond between two neighbor C\textsubscript{60} in (111) plane. We have measured the specific heat of C\textsubscript{60} polymer and pristine C\textsubscript{60} by means of PPMS, and the measurement proceeded in the temperature range from 2 to 300K. The experimental result of pristine C\textsubscript{60} agreed well with previous report. For C\textsubscript{60} polymer, above T=80K it is found that temperature dependence of the specific heat is similar to that of pristine C\textsubscript{60} besides an anomaly from order-disorder phase transition at 260K, but in range from 2 to 80K the specific heat is much less than that of pristine C\textsubscript{60}. Assuming three-dimensional (3D) and two-dimensional (2D) Debye phonon modes to contribute respectively to the specific heat in different temperature zone, the calculated values of specific heat have got a good agreement with the experimental data in the whole temperature range. These results show the 2D planar modes but not 3D modes are a dominator to the specific heat of C\textsubscript{60} polymer, and the low-frequency intermolecular modes of C\textsubscript{60} lattice are restrained in the case of C\textsubscript{60} polymer by sp\textsuperscript{3} bonds from 2+2 cycloaddition reaction.

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