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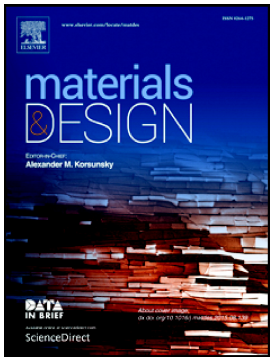

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Controllable synthesis of carbon-nanocoil–carbon-microcoil hybrid materials

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The synthesis of carbon-nanocoil—carbon-microcoil (CNC–CMC) hybrid materials, namely carbon nanocoils (CNCs) formed together with the growth of the carbon microcoils (CMCs), were achieved using C_2H_2 as the source gas and SF_6 as an additive gas in a thermal chemical vapor deposition system. During the reaction, SF_6 was injected into the reactor in modulated on/off cycles. The CNC–CMC hybrid materials were not observed without the on/off cycles of SF_6 flow. When we varied the number of the on/off cycles, the density of CNCs formed in the CNC–CMC hybrid materials increased with increasing cycle number. The cause for the difference in CNC–CMC formation with cycle number was investigated. Based on the results, a growth mode of the CNC–CMC hybrid materials was proposed.

Keywords: Carbon nanocoils, Carbon microcoils, Hybrid materials, Cycling modulation, SF_6 gas flow, Thermal chemical vapor deposition