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Synthesis and investigation of reaction mechanisms of diamondoids obtained by dielectric barrier discharge microplasma reactors operated in adamantane - argon - methane - hydrogen mixtures at atmospheric pressure[1] SVEN STAUSS, CHIKAKO ISHII, The University of Tokyo, DAVID Z. PAI, Institut Pprime CNRS UPR 3346, Université de Poitiers, ENSMA, KAZUO TERASHIMA, The University of Tokyo — Diamondoids, sp^3 hybridized molecules consisting of a cage-like carbon framework with hydrogen terminations, hold promise for many applications: biotechnology, medicine, and opto- and nanoelectronics. So far, diamondoids consisting of more than four cage units have been synthesized by electric discharge and pulsed laser plasmas in supercritical fluids, but the generation of plasmas in high-pressure media is not straightforward. Here we present an alternative, continuous flow process, where diamondoids are synthesized by dielectric barrier discharges inside microreactors. The plasmas were generated at peak-to-peak voltages of 3 - 4 kV at a frequency of 10 kHz, in Ar (96 - 100%-vol) - methane (0 - 4%-vol) - hydrogen (0 - 4%-vol) mixtures, at atmospheric pressure and flow rates of 2 - 20 sccm. As a precursor we used the first diamondoid, adamantane, whose density was controlled by adjusting the reactor temperature in the range from 293 to 323 K. Gas chromatography - mass spectrometry analysis indicated the synthesis of the second diamondoid, diamantane, and the presence of alkylated adamantane derivatives suggests a stepwise reaction mechanism. We will also discuss the influence of the plasma gas composition and precursor density on the diamondoid synthesis.

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