Semiconducting Soft Submicron Particles from the Microwave-Driven Polymerization of Diaminomaleonitrile

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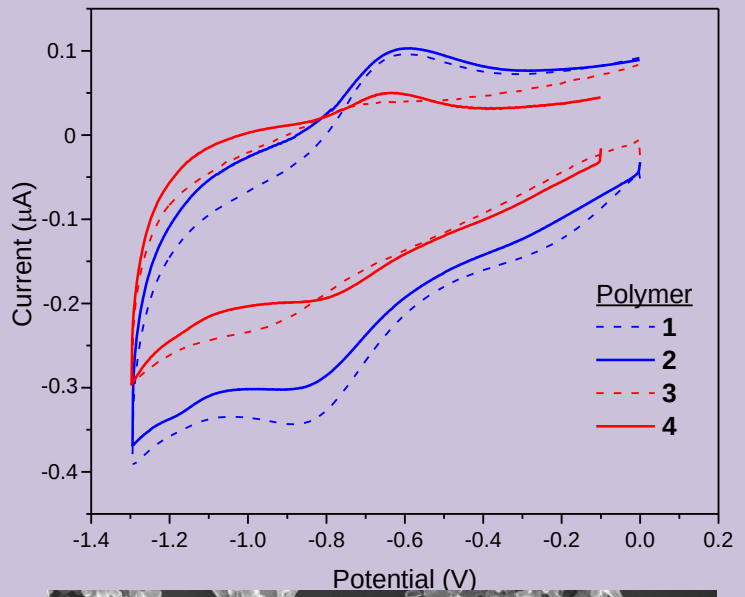

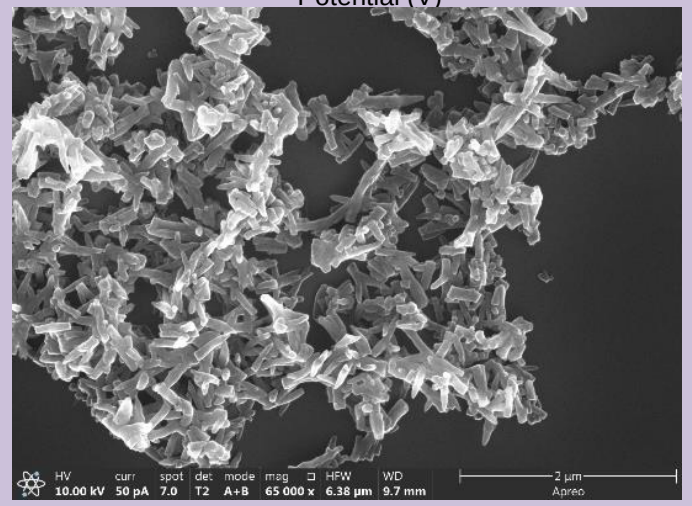

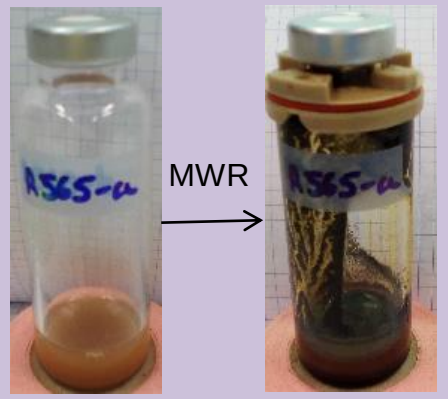

The polymers based on diaminomaleonitrile (DAMN polymers) are a special group within an extensive set of complex substances, namely HCN polymers (DAMN is the formal tetramer of the HCN), which currently present a growing interest in materials science. Recently, the thermal polymerizability of DAMN has been reported, both in an aqueous medium and in bulk, offering the potential for the development of capacitors and biosensors, respectively. In the present work, the polymerization of this plausible prebiotic molecule has been hydrothermally explored using microwave radiation (MWR) via the heating of aqueous DAMN suspensions at 170–190 °C. In this way, polymeric submicron particles derived from DAMN were obtained for the first time. The structural, thermal decomposition, and electrochemical properties were also deeply evaluated. The redox behavior was characterized from DMSO solutions of these highly conjugated macromolecular systems and their potential as semiconductors was described. As a result, new semiconducting polymeric submicron particles were synthetized using a very fast, easy, highly robust, and green-solvent process. These results show a new example of the great potential of the polymerization assisted by MWR associated with the HCN-derived polymers, which has a dual interest both in chemical evolution and as functional materials.

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