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Conducting polymers: Synthesis and kinetic study by pulsed radiolysis

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Conductive Polymers (CP) have nowadays many applications in several devices; for this reason much attention has been dedicated to them in recent years. CP has gained some large scale applications for their chemical and physical properties. Although, the synthesis of CP has been widely studied for a long time, many efforts are still aimed to simplify their preparation, to tune their morphology and optimize their properties. Despite intensive research, the mechanism of conducting polymers growth is still poorly understood and the methods of polymerization are limited to two principal ways: Chemical and electrochemical synthesis. Radiation chemistry deals with the chemical reactions resulting from the interaction of high-energy photons or particles with matter. In our group, a new strategy to synthesize CP in aqueous solutions by using ionizing radiation was developed Lat131Lat141Cui141Col151. This new alternative method enables the polymerization under soft condition like ambient temperature and pressure, without dopant. Recently pulse radiolysis has been used to study the mechanism of polymerization of CP in aqueous solution. A step-by-step mechanism was found and it involves a recurrent oxidation process. The use of different oxidizing radicals (i.e. HO., CO_3.-, N_3.) allows us to identify the intermediate species involved in the growth mechanism. The value of rate constants and the attribution of transient and stable species were confirmed by molecular simulations and spectro-kinetic analysis. Moreover, it was also possible to polymerize CP by using an electron beam. The irradiation with a series of consecutive electron pulses enables the *in-situ* synthesis of CP. These CP were evidenced by UV-Vis and IR spectroscopy and cryo-TEM, SEM and AFM-IR microscopes which showed globular morphologies. Investigation on electrical characteristics depicts values of conductivity comparable with the polymers synthesized by chemical or electrochemical methods. The present study bears a witness to the tremendous potential of such a brand new electrons-based methodology and gives us a glimpse of future promising industrial applications in the field of CP synthesis.

Biography

Cecilia Coletta is a PhD student in Physical Chemistry at Université Paris Saclay, France. She has published three papers so far and has presented her works in several international conferences.

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