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Low temperature plasma life innovations: Functional reaction networks of radical chemistry

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Plasma processing technologies involve physical processes induced by electron collisions with precursors to produce unstable, short-lived reactive species that subsequently react with other species to generate various products. As an example, discharges in air with water vapor, a hydroxyl and nitrosyl radicals is first generated, following which chain growth occurs via initiation and propagation, in conjunction with termination reactions. Typically, the reaction is terminated by the addition of radical inhibitors, and this process tends to provide nonlinear growth of the chemical chains. The initiation step is dependent on the initial concentration of radicals, and the propagation reaction is controlled kinetically in conjunction with a continuously changing nonequilibrium state. This paper stressed the importance of understanding the dynamics of complex networks based on kinetically-driven reactions in nonequilibrium states, using empirical data. On this basis, it should be possible to control the functionalization of living organisms by employing common principles associated with the spatiotemporal atomic scale localization of reactive species.

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