UV laser photolyses to enhance diamond growth

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Energy influences the rates of chemical reactions dramatically. Simply heating a gas-phase reaction system deposits energy indiscriminately in internal and translational motions of precursor and intermediate molecules.

More specific excitations of energy states in the molecules can control the courses of a reaction. Control of chemical reactions is an intriguing concept. The practical reasons for seeking such control range from suppressing unwanted side products to synthesizing new material structures. After significant advances in laser technology, lasers can now provide a unique means of selectively driving chemical reactions by exciting specific transitions in reactant molecules. Ultraviolet photochemistry has long been exploited to gain chemical control in molecular reactions motivated by suppressing side-product channels to obtain the desired deposit.

However, there have been few successes in practical material synthesis because the photochemical effects have been too weak. Nevertheless, selectivity among various competing chemical processes in material synthesis is attractive because it enables a better understanding of the reacting channels, leading to process control and improvements.

Researchers at the University of Nebraska-Lincoln, reported on a new laser-enabled synthesis route to explore the advantages of laser photochemistry in practical material synthesis in a recent article in *Light: Science & Applications*. In this work, it is demonstrated that UV laser photolysis of hydrocarbon species altered the flame chemistry to promote the diamond growth rate and film quality. The authors found that the UV laser photolysis plays a key role in suppressing the formation of the side products, nondiamond carbons. This discovery suggests the great potential of the laser photolysis forsignificantly improving the synthesis of a broad range of technically important materials.

More information: *Light: Science & Applications* (2018). DOI: 10.1038/lsa.2017.177 , www.nature-lsa.cn:8080/cms/acc … s/AAP-lsa2017177.pdf

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