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Utilization of continuous low power visible laser in the 3D printing of strong and ultra- light weight cross-linked silica aerogel

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3D printing of strong and lightweight materials is playing an increasingly significant role in many applications such as the 3D printing of designs and prototypes, architectural models, consumer products, electronics, and printing technologies. Various materials and methods have been explored for 3D printing such as laser sintered metals, photo-cross-linked polymers and extruded molten polymers. Recently, lasers, laser-assisted 3D printings are getting much attention over traditional methods of 3D printing due to their flexibility and efficiency. Current 3D involve the use of a high power and pulse lasers such as carbon dioxide laser or ultraviolet (UV) lasers. In this paper, we present the synthesis of polymer cross-linked silica alcogels in a matter of seconds by illuminating a precursor solution of an alkoxide, a monomer and a visible-light photo-initiator using a 2 Watt laser beam (532 nm). The illumination initiates free-radical polymerization then the heat of polymerization triggers gelation instantly. We have successfully demonstrated a manual printing of 3D letters on different substrates like laminated paper, a glass slide and a silicon wafer using masking techniques, and also the printing of a 50 mm thick line on a glass substrate through direct shining of a laser on the liquid mixture without any mask. Our results indicate that the instantaneous and simultaneous polymerization and gelation of silicon alkoxide precursor and polymer can lead to the fabrication of mechanically strong and ultra-lightweight silica aerogels which offers a new direction for the 3D industry.

Biography

Khaled M Saoud is Associate Professor of Physics at Virginia Commonwealth University in Qatar. He has completed his PhD in 2005 in Chemical Physics at the Chemistry and Physics departments, Virginia Commonwealth University. He held many industrial positions at major American companies such as Philip Morris USA, Intel Corporation, and Nova Measuring Instruments Inc. He has been working in the field of Nanotechnology since 1998. He published over 40 research papers in the field of Nanotechnology and holds two US patents.

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