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# Effect of Deposition Temperature on the Composition and Properties of Propanethiol Plasma Polymer Thin Films

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Synthesis of high refractive index (n > 1.65) polymeric films is a topic of interest for the implementation in advanced photonic devices. Due to their high molar refractions, the chemical polymerization of sulfur containing monomers is one of the approaches successfully used for the development of high refractive index material. In this regards, the present work investigates the solvent-less synthesis of highly-sulfur-concentrated organic thin films by the plasma polymerization of propanethiol. The films were deposited in a radio frequency inductively coupled plasma reactor that can be operated in two different regimes denominated capacitive (E) and inductive (H) modes. Our first results revealed that the atomic sulfur concentration varies within a wide range (15-40 %) depending of the plasma mode. Further mass spectra analyses suggest that such high concentration may be accounted by the preferential incorporation of sulfur based moieties. As a main novelty this work shows that this process depends on the substrate temperature which in case H mode is strongly affected by the physicochemical processes at the growing-film/plasma interface. Experiments conducted at controlled temperature, with the help of an external cooling circuit, shows that the S content of the films is related to the production of $H_2S$ in the glow discharge. These experiments also confirm the role of the substrate temperature on the synthesis of plasma polymeric films with high sulfur content. The acquired control enables to develop optical thin film with a controllable refractive index, from 1.69 to 1.82, being the latter one within the highest refractive index reported in organic materials.

**Keywords**
plasma polymer
sulfur
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