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SOLVENT FREE PRINTING OF ELECTRONIC CIRCUITS WITH SILVER NANOPARTICLES PREPARED BY A GREEN AND CONTROLLED SYNTHESIS

R. KLAAS [1], R. DR. SCHNEIDER [1], M. PROF. BUCHMEISER [1]

[1] *Stuttgart University, Institute of Polymer Chemistry, Stuttgart, Germany*

Progresses in the fabrication of printed electronics have opened the door for the production of portable, flexible and very low-cost electric circuits. Concrete examples for printable electronics are photovoltaics, antennas, flexible displays and batteries, sensors, RFID tags, lighting devices, resistive heaters and transistors. It is known from literature that recent investigations focused on the integration of conductive tracks on flexible polymer foils, paper and textile fabrics. [1, 2, 3]

For the fabrication of printed electronic devices different printing technologies can be used such as screen printing, gravure, offset lithography, flexography or inkjet printing. Inkjet printing offers a number of advantages compared to the other printing techniques. It is a digital printing technology and therefore no special templates have to be fabricated and it is a nonimpact printing procedure with inks of low viscosity.

Since the end oft the 20th century, special fabric printers using colour ink-jet technology by digital printing are inexpensively available on the market. Investigations were made to use these standard commercial printers for the fabrication of highly conductive patterns on textile fabrics. Therefore special water-based, non-toxic, solvent-free, ‘green‘ inks had to be prepared.

Silver was chosen as conductive material because it has the highest electrical conductivity of all metals. During the last years, the synthesis of silver nanoparticles has attracted tremendous interest. Different synthetic methods have been developed and in few cases details on mechanism of formation are known.[4, 5] Here, we present a new synthesis that allows for controlling the nanoparticle size and thus preparing water-based silver inks for textile printers. The particles were characterized using different techniques like DLS, UV/Vis spectroscopy and SEM micrographs. An overview of ink preparation will be given on the poster.

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Keywords: *Nanotechnology; Silver; Sustainable Chemistry;*

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TOPOCHEMICAL REACTIONS IN FULLERENE BASED CRYSTALS

E. KOVATS [1], G. BORTEL [1], S. PEKKER [1]

[1] *Institute for Solid State Physics and Optics Wigner Research Centre for Physics, Experimental Solid State Physics, Budapest, Hungary*

Topochemical reactions in fullerene-based crystals can be originated from crystal- and molecular structural features. Fullerenes are the 3D analogues of planar aromatic systems, their reactivity comes from reactive double bonds. The basic material, C_{60} has various solid phase reactions in pure crystals and in cocrystals too.

In pure fullerene crystals photopolymerization can occur by the effect of light resulting small sized cycloadduct fullerene homo-oligomers. We worked out a new method to produce C_{60} photopolymer in gram scale [1], and we detected several small sized oligomers, and obtained solvent-free photo-dimer crystals.

Based on the relatively big size of the fullerenes big cavities can be found in the crystal structure with different symmetries. Small guest molecules can be built into these voids. We showed that with reactive guest molecules, like piperylene or small azides topochemical reactions can be carried out with high selectivity and good yield.

Several high symmetry cocrystals arise with the combination of fullerenes and cubanes [2]. These supramolecular crystals have unusual dynamics based on the match of molecular surfaces of the rotating and static components, that we called ‘rotor-stator property’. We showed that rotor-stator systems can be formed with C_{60} and higher fullerenes too and also with disubstituted cubane derivatives. At elevated temperature a single phase copolymerization occurs induced by the thermal decomposition of cubanes.

Acknowledgement: *This work has been supported by the grant OTKA T072954. G. B. and É. K. acknowledge support of the Bolyai János Scholarship of the Hungarian Academy of Sciences.*

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Keywords: *fullerenes; topochemistry; cocrystals;*