TECHNISCHE UNIVERSITÄT DRESDEN

Molecular silver ink
-
A photoreducable ink for thin silver films

Information, quantities and prices:

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Appearance and Properties

We have designed a **new silver(I) complex** which is easy obtainable by the reaction of silver nitrate and the organic ligand at room temperature. The resulting complex contains **31 wt-% silver** and is well soluble in common solvents such as water, ethanol, acetone and mixtures of those. The solutions of the complex can be used as a precursor suitable for the preparation of thin compact and structured silver films. An **UV-irradition of 15-20 minutes** yields elemental silver (Figure 1). With an additional **thermal treatment at 220-250 °C** the organic ligand can be removed increasing the crystallinity.

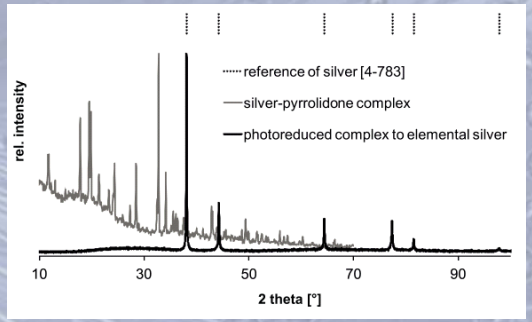

Figure 1: PXRD pattern of the silver complex (grey) and elemental silver obtained after 15-20 minutes UV-irradiation and additional thermal treatment at 220°C(black).

Thin compact and structured films

The well solubility of the silver complex in common solvents allows the use as an ink for the preparation of thin compact as well as structured silver films. Figure 2 shows the schematical procedure to fabricate thin compact silver films *via* dipcoating the complex solution and subsequent photoreduction.

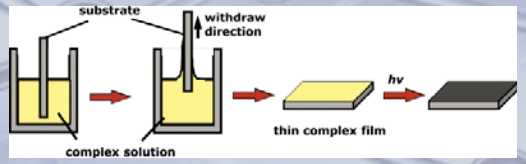

Figure 2: Schematical description of the dipcoating process to fabricate thin compact silver coatings.

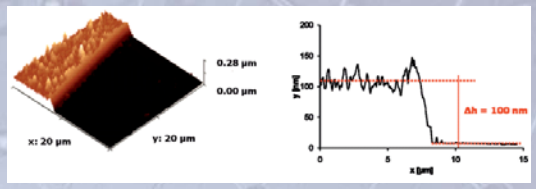

Figure 3: AFM image of a scratched edge at the compact film (left) to calculate the film thickness which is shown in the height profile (right).

Figure 3 shows the analysis of the film thickness using atomic force microscopy (AFM). With the dipcoating technique films with a **thickness of about 100 nm** and respective **sheet resistances down to < 10 ?/sq** can be prepared.
To obtain defined structured patterns of silver soft printing techniques like micro contact printing (µcp) or embossing can be applied. Figure 4 shows the results of printed silver lines using an embossing process on glass substrates. The **moderate thermal treatment at 220-250 °C after photoreduction** allows also for **printing on flexible substrates**. The simplicity in application and the excellent features of the released silver films make the silver complex an convenient ink for optical applications with regard to solar cells or light emitting devices.

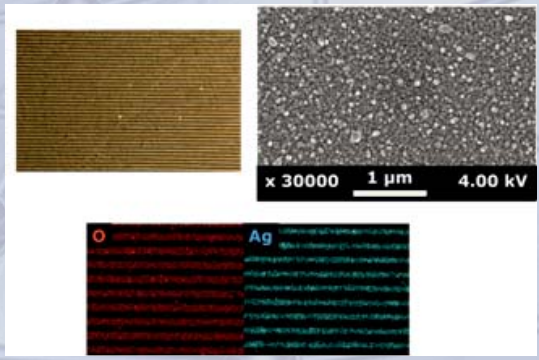

Figure 4: Optical microscope image of silver lines (top left), SEM image shows the compactness of silver in the lines (top right) and EDX-mapping the existence of silver only at the printed areas (bottom).