Fabrication of Conductive Patterns in Au(dmit)$_2$ Films using an *AC* Electrochemical Method

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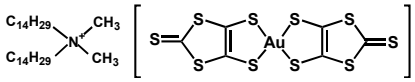

$2C_{14}$-Au(dmit)$_2$ salt

We report on a technique to fabricate conductive patterns in molecular thin films using an *AC* electro-oxidation process. The ditetradecyldimethylammonium-Au(dmit)$_2$ ($2C_{14}$-Au(dmit)$_2$) salts were spread at the air/water interface and transferred onto Si wafers or glass plates by the horizontal lifting method. Prior to the film deposition, gold electrode strips with gaps of 20-500 μm were vacuum deposited on the substrates. The films were immersed in an aqueous solution of $LiClO_4$ and an AC voltage with an amplitude of 0.5-1.5 V (f=2.0 kHz, square waveform) was applied along the film plane.

Figure 1 shows crossed polarized light micrograph of the 20-layered $2C_{14}$-Au(dmit)$_2$ LB film. The electro-oxidation first occurs on the electrode/film interface and then the oxidation fronts proceed from both electrode edges. Micro crystals observed in the oxidized areas have a uniaxial molecular arrangement.

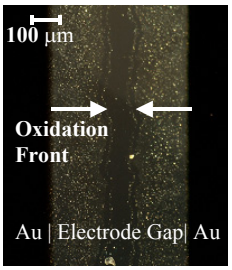

Fig. 1. The crossed polarized light micrograph during the *AC* electro-oxidation.

We have already reported that the electro-oxidized $2C_{14}$-Au(dmit)$_2$ LB film has a metallic resistance [1, 2] and a magnetic anomaly suggesting the existence of superconductivity [3]. However, a *DC* potential was applied across the film plane using a Pt counter electrode set in front of the film surface in the electrolyte. Thus, the conductive micro crystals are generated isotropically in the film plane. The present technique may allow us to bridge the electrode gap to realize better macroscopic conduction and even has a potential to become a versatile technique to fabricate various conductive patters in molecular thin films.

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[2] Y. F. Miura et al., Jpn. J. Appl. Phys. **47** (2008) 8884.
[3] Y. F. Miura et al., Solid State Commun. **113** (2000) 603.