

Synthesis, Characterization and Application of Noble Silver Precursors: Process for Metal Patterning without Use of Photo-resist

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In recent years, the fabrication of metallic patterns is important research areas for many scientists because it plays an essential role in the microelectronics industry¹. A conventional method to make metallic patterns includes various steps, and thus having a disadvantage of a high production cost due to the complicated processes.

Meanwhile, there are distinct trends in the FPD (flat panel display) industry and the related manufacturing technologies, with FPD production technologies focused on three different applications: TFT-LCD, PDP and OLEDs display. Especially large glass substrates require constant R&D in a relentless race to reduce production costs. For this purpose, it is necessary to reduce resistivity of metal interconnection. In nowadays, aluminum and copper metals are used in this purpose mainly, but silver metal is also possible candidate because silver metal has the lowest resistivity and a higher electromigration resistance was observed than for Al lines processed under identical conditions².

In this paper, we report the preparation of noble organosilver complexes and spin on metal (SOM) process, which is simple than conventional method, for direct metal patterning. The brief preparative method for organosilver precursors is shown in scheme 1 in which X and L represent anionic and neutral ligands, respectively.

As shown in scheme 2, the precursor film is obtained by spin coating on a suitable substrate. Here, it is necessary to have amorphous property of precursor that forms a high quality organosilver film. Broadband UV is used in this process to selectively activate molecules, initiating the conversion to metallic silver in the exposed regions. The unexposed regions are removed by development in a solvent. And then, reducing step is followed to make pure metal film. To obtain metal oxide film we can use of oxidizing agent instead of reducing agent in this step.

To demonstrate the utility of this process for the directly patterned metal films, a 100nm Ag film was prepared by SOM method under a test mask. Figure 1 shows the scanning electron micrograph of the film with a test pattern. As shown in Fig.1, it was possible to write patterns of less than 8 μm feature size. And also, based on the X-ray diffraction analysis, we can show that the Ag film is well-crystallized polycrystalline Ag metal film.

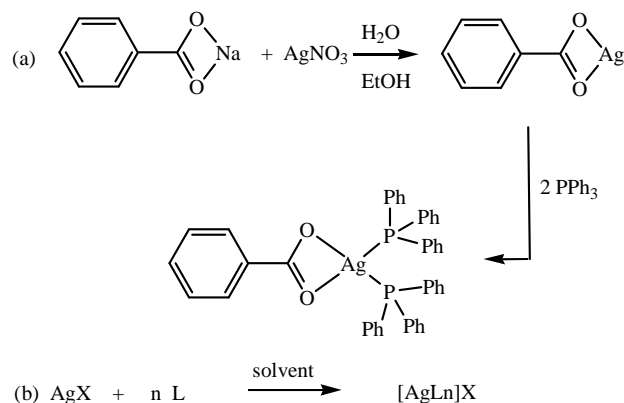
SOM method using the photo-definable organometallic precursor allows us to produce, in a kinetic fashion, various materials via the photodecomposition of precursor molecules under controlled conditions. Synthesis, characterization and application of those compounds will be discussed in detail.

References

¹ For a general review, see L. F. Thompson, C. G. Willson, and M. J. Bowden, eds., *Introduction to Microlithography*, ACS Symposium Series (American Chemical Society, Washington, DC, 1983).

² T. L. Alford and J. W. Mayer, *Book of Abstracts, Materials for advanced Metallization* (Stresa, Italy 2000).

Scheme 1. Preparation of silver complexes



Scheme 2. Simplicity of SOM process

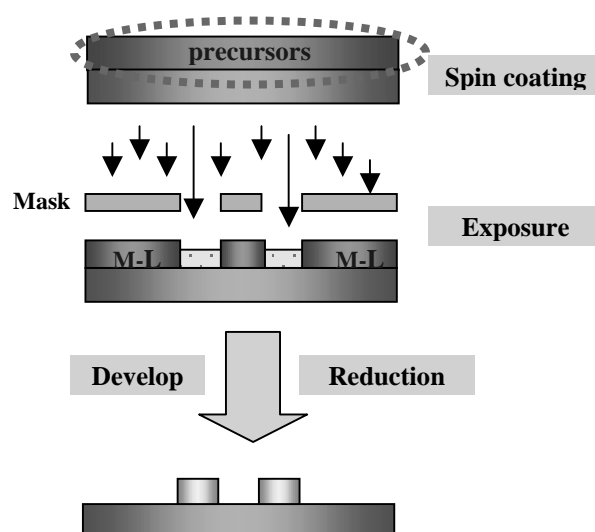


Figure 1. Scanning electron micrograph of a patterned Ag film deposited by SOM process.

