Electrical Properties of Copper Oxide Thin Films Deposited by Atomic Layer Deposition

Byung Kook Lee¹,², Jae Ki Min¹, Sun Sook Lee¹, Taek-Mo Chung¹,
Chang Gyoun Kim¹, Jin Ha Hwang², Ki-Seok An¹

¹Device Materials Research Center, Korea Research Institute of Chemical Technology
²Department of Material Science and Engineering, Hongik University, Seoul, Korea

Recently, metal oxide semiconductors have been investigated for microelectronics device applications, such as thin film transistors (TFTs) channel layer and non-volatile memories, etc. However, most reported metal oxide semiconductors are n-type. Therefore, development of p-type metal oxide semiconductors are required for application of complementary metal-oxide-semiconductor (CMOS) using n- and p-type, and p-n junction devices.

Generally, copper oxide thin films, exiting CuO and Cu₂O, have p-type conductivity that they have possible application for p-channel layer of TFTs and p-n junction devices. Besides, theses materials have some advantages such as low production cost and non-toxic.

In this study, copper oxide thin films are prepared using Cu(II) aminoalkoxide precursor Cu(dmamb)₂ [dmamb = 1 - dimethylamino - 2 - methyl - 2 - butanolate OC(Me)(Et)CH₂NMe₂] with water and oxygen plasma, as oxygen sources by ALD and investigated for possibility of p-channel TFTs application as a p-type semiconductor. The self-limiting ALD process was estimated by thickness of the films measured as function of the Cu(dmamb)₂ pulse time and the number of ALD cycles. The properties of the films were performed by XPS, AES depth-profile and AFM. To investigate the optical and electrical properties, as-grown and annealed samples were measured by UV-vis and Hall measurements.