Chemical solution deposition of copper thin films and integration into a multilayer capacitor structure

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Abstract: Metallization layers with thicknesses well below a micron are needed for future generation multilayer ceramic devices such as capacitors and integrated passive components. In many cases, the limiting thickness for the electrode is governed by dewetting of the metals from the oxide surface. Therefore, thin, stable metallization layers with low electrical resistivities that can survive high processing temperatures are of interest for these applications. For this purpose, Cu films prepared from 2-methoxyethanol-based solutions were developed using adhesion promoters such as Ti, Zn, and Zr. The solutions were spun onto $BaTiO_3/SiO_2/Si$ or SiO_2/Si substrates, pyrolyzed, and annealed in a reducing ambient. The microstructure of films prepared in this way was found to be uniform and continuous at thicknesses as low as 80 nm. Cu films modified with 15 mol% Zr had electrical resistivities of about 16-17 μΩ.cm after 500 ºC annealing and 5-6 μΩ.cm after annealing at 900 ºC in a reducing ambient.