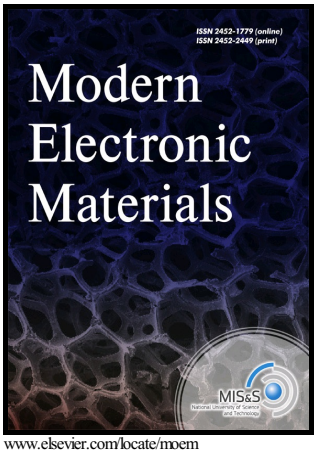

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Metallic nanofilms on single crystal silicon: growth, properties and applications

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Abstract. The metal–silicon thin-film system is not isostructural and furthermore exhibits pronounced interdiffusion and chemical reactions. Therefore the growth of metallic films on silicon leads to a high concentration of defects in the film, especially at its substrate interface. The material also contains stress and a transition layer consisting of melts or compounds (silicides).

We have considered theoretical viewpoints and reviewed experimental data on the growth and properties of metallic nanofilms (including multilayered ones) on silicon, and also provided a brief review of their applications. The films consist either of atomic-sized, quabquantum sized and quantum sized layers. We have suggested a low temperature film growth technology based on freezing growing layers during deposition by maintaining a low temperature of the substrate and using an atomic beam with a reduced heat power. The technology uses a specially shaped deposition system in which the distance between the source and the substrate is comparable to their size or smaller. Furthermore, we use a special time sequence of deposition that provides for a reduced substrate surface temperature due to greater intervals between deposition pulses. This growth method of atomically thin films and multilayered nanofilms excludes interdiffusion between the layers, reduces three-dimensional growth rate and relatively increases lateral layer growth rate.

Keywords: metal, silicon, silicide film, single crystal substrate, interdiffusion, reaction, growth, molecular beam flow, low temperature growth, growth methods

Introduction