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Nobel metal alloyed thin-films with optical properties on demand

CHEN GONG, MARINA S. LEITE, Department of Materials Science and Eng., Institute for Research in Electronics and Applied Physics, Univ. of Maryland, College Park, MD 20742 — Metallic materials with tunable optical responses can enable the unprecedented control of optoelectronic and nanophotonic devices with enhanced performance, such as thin-film solar cells, metamaterials and metasurfaces for tunable absorbers and optical filters, among others. Here we present the alloying of noble metals, Ag, Au and Cu, to develop a novel class of material with optical response not achieved by pure metals. We fabricate binary mixtures with controlled chemical composition by co-sputtering. Ellipsometry and surface plasmon polariton coupling angle measurements are in excellent agreement when determining the real part of the dielectric function ($\varepsilon 1$). Surprisingly, in some cases, a mixture provides a material with higher surface plasmon polariton quality factor than the corresponding pure metals. Our approach paves the way to implement metallic nanostructures with tunable absorption/transmission, overcoming the current limitation of the dielectric function of noble metals.

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