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Laser Processing of Metal Oxides for Plasmonic Applications[1]
HEUNGSOO KIM, Naval Research Laboratory, ERIC BRECKENFELD, National Research Council Fellow at Naval Research Laboratory, NICHOLAS CHARIPAR, ALBERTO PIQUE, Naval Research Laboratory — Noble metals such as Au and Ag have been used traditionally for plasmonic devices. However, conventional metals are not suitable for near infrared (IR) plasmonic applications due to their relatively large optical losses at these wavelengths. Metal oxides, on the other hand, have been considered for low loss metallic components in the near IR because they can provide a tunable carrier density by doping. The zero-cross-over permittivity values of these metal oxides, for example, can easily be tuned from 1.0 m to 3 m by adjusting doping levels. Optical losses in devices made from these metal oxide materials are generally found to be much lower than those obtained with conventional metals. We have investigated various laser processing techniques for synthesizing several types of metal oxides. First, pulsed laser deposition was used to grow metal oxide thin films such as, Al-doped ZnO, Sn-doped In2O3 and VO2. Second, a laser sintering technique was used to improve the properties of solution-processed VO2 coatings. Third, a laser printing technique was used to produce metal oxide films. We will present details on the use of laser processing techniques for synthesizing these metal oxides along with their electrical, optical, and structural properties.

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