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Effects of Surface Plasmonic Electric Field Enhancements on Thin Film Vanadium Dioxide's Insulator to Metal Transition State.[1] SCOTT MADARAS, JASON CREEDEN, College of William and Mary Dept. of Physics, SALINPORN KITTIWATANAKUL, JIWEI LU, University of Virginia Dept. of Materials Science and Engineering , IRINA NOVIKOVA , ROSA LUKASZEW, College of William and Mary Dept. of Physics — We investigate the possibility to use an insulator to metal transition (IMT) in vanadium dioxide (VO_2) films for a new type of efficient photodetectors. Our goal is to lower the optical power required to achieve IMT by using surface plasmons (SP) which are known to dramatically enhance the electric field at the interface with a noble metal. Thus, we study the effect of SP excitation in the layered structure consisting of a 31nm Au film and 5nm VO_2 film, deposited on a glass substrate. Our theoretical model predicts that in such a structure a strong electric field enhancement, 89 times the field at the glass-Au interface, will occur in VO_2 at 1064nm laser wavelength when SP are excited. A model of the SP electric field enhancement effect in VO_2 coupled with the differences in fractional amounts of VO_2 converted between metal and insulator is being used to design and guide experimental measurements. It is expected that, if successful, this method will reduce the optical power requirements for the photo-induced IMT. In the case of using this method in conjunction with ultrafast laser IMT transition methods, it may lower the required transition energy and possibly improve the VO_2 time recovery between metal to insulator.

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