**Inverse design strategy for achieving high bolometric performances via optimizing multilayered oxide heterostructure**

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The vanadium dioxide (VO2) are considered as most promising candidates in terms of uncooled bolometric materials because of its high temperature coefficient of resistance (TCR) due to metal-insulator transition (MIT) at 68 °C. However, despite the high TCR, the other characteristics of MIT in VO2, narrow transition temperature range, presence of hysteresis in transition and high deposition temperature for example, must be overcome to high-performance bolometric devices. Since the MIT of VO2 comes from the change of crystal structure which shows monoclinic insulating phase at low temperature and rutile metallic phase at high temperature, many methods like introducing buffer layer to increase TCR or lowering deposition temperature by enhancing the crystallinity of VO2 or injecting different dopants to modify transition temperature are reported. In this research, we propose a strategic method to overcome the inherent limitations of VO2 by inverse design optimization of multilayered VO2 with different tungsten doping ratios. The VO2 films with high TCR are deposited by pulsed laser deposition with low deposition temperature (300 °C) for CMOS compatibility can be achieved by introducing TiOx buffer layer on SiO2/Si substrate. The multilayered structures of tungsten-doped VO2 (WxV1-xO2) consists of four different layers with doping ratio of 0, 0.5, 2 and 4 % are optimized using The reinforcement learning algorithm via modulating thickness of each doped layer, aiming to refine bolometric performance of the multilayer film for two specific functionalities: the one is achieving a nearly constant high TCR and the other is about linear TCR response in broad temperature range. Our results demonstrate that the optimized multilayers for a flat TCR configuration sustain a TCR of 5%/K over 20 K temperature range and for the configuration of linear TCR achieved linear TCR response with no inflection points over a 16.5 K span. These advancements present a significant step forward in the practical application of the vanadium oxide films in advanced microbolometer technologies.