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Ultrafast Optical Nonlinearity of V4O7

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The V4O7 material is one of the correlated vanadium oxides with non-trivial metal-insulator transition (MIT) behavior. This oxide belongs to Magneli phases (VnO2n-1, n=3,4,...,9) and shows reversible MIT at temperature Tc~237K. Similar to other vanadium oxides, V4O7 shows exotic electronic, magnetic, and optical properties due to strong electron-electron correlations. Here we report on photoinduced optical dynamics of V4O7 within a broad range of sample temperatures. Thin stoichiometric V4O7 films were synthesized by direct current sputtering technique. The observed optical dynamics of V4O7 show complex transient nonlinearity, and suggest a significant contribution of polaronic effects. Owing to strong electron-electron correlations in Low-T V4O7, its insulating phase can be understood in terms of Wigner crystallization of small polarons. Photoinduced screening of electronic correlations results in melting of polaronic order into noncorrelated polaronic states accompanied by increased conductivity. The characteristic photoinduced dynamics of V4O7 in High-T and Low-T phases reveal multistage evolution of electronic and phonon subsystems with specific threshold behavior for the Low-T phase associated with insulator-to-metal phase transition.

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Topics

Session A. Physics of condensed matter and spectroscopy

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