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The role of electrons in NiTi-based shape memory alloys

Nickel-titanium (NiTi) based alloys are an important representative of the shape memory alloy class. However, the role of electrons in this transformation leading to the shape memory effect is not yet fully understood. Using resistivity, Hall coefficients, and Seebeck coefficients in combination with terahertz reflectivity, we have characterized transport anomalies in various NiTi compositions. We found that the charge carrier density obtained by these measurements is reduced by almost an order of magnitude in the martensitic phase compared to the austenitic phase. Together with the reduction in charge carrier density, the charge carrier mobility in martensite is significantly increased compared to austenite. The experimental data indicate a partial transfer of electron density from the free electron gas (austenite) to the bond (martensite). We interpret this in terms of the formation of a charge density wave phase and discuss the significance for the energetic driving forces of this phase transition.

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