PLASTICITY OF TOPOLOGICALLY CLOSE-PACKED PHASES IN THE FE-TA(-AL) SYSTEM

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Understanding the structure-property relationships of materials plays a significant role in the development of materials for technical applications. Due to the many possible combinations of two or more elements, intermetallic phases can be very interesting for these developments. High strength up to high temperatures makes intermetallics promising materials for high-temperature applications. However, their complex structure, resulting in a pronounced brittleness, has so far limited their applicability. We focus on the understanding of plastic deformation in topologically close-packed (TCP) phases, which form one of the largest groups of intermetallics. To do this, we use nanomechanical tests that allow us to study plasticity even in the most brittle materials. Here, we consider the Fe-Ta(-Al) system that contains two closely related TCP phases, a C14 Laves phase and a μ-phase. The building block-like structure of these phases enables a systematic investigation as well as a transfer of the findings to other complex crystals. The mechanical properties of the two TCP phases in the Fe-Ta(-Al) system, investigated by state-of-the-art micromechanical testing, are introduced in this work. The influence of the crystal structure and chemical composition on the mechanical properties and the deformation mechanisms of the TCP phases are discussed.