"The Effect of Metastability on Room Temperature Deformation Behavior of Beta Titanium Alloys"

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The deformation behavior of single-phase metastable beta titanium alloys and two-phase metastable α+β alloys strongly depends on the degree of stability of the beta phase. Recently, it has been shown that the tensile deformation behavior as well as the creep deformation behavior at room temperature is strongly influenced by the degree of metastability. For example, the beta titanium alloy Ti-13wt%Mn, which has higher stability than the beta titanium alloy Ti-14.8wt%V, deforms by slip only; whereas the latter deforms by slip and twinning. In addition to the mechanical properties, the deformation mechanisms also depend on the degree of metastability. Further, the deformation mechanisms of a given metastable beta alloy depend on whether the beta phase is present by itself as a single phase alloy, or in the presence of α phase in the form of a two phase alloy. For example, it was found that a metastable Ti-V alloy deforms by slip and twinning when it is in the presence of a single phase alloy, but deforms by slip and martensitic formation when the same metastable beta phase is present in a two phase α+β alloy. The mechanical properties of the metastable beta alloys, in turn depends on these deformation mechanisms. These developments will be reviewed in this presentation and the ramifications of these findings in regard to the design and selection of titanium alloys for various applications will be presented. This work is being supported by the National Science Foundation under grant number DMR-0513751.