Deformation Mechanisms in Ti and Zr

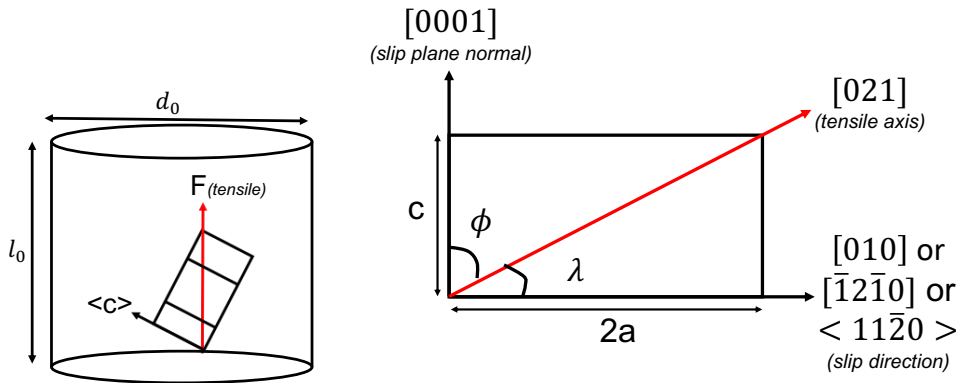
Practice Questions

Please try to answer this question asked in the online video.

1. Why is prismatic <a> slip easier than basal <a> slip in both Ti and Zr alloys?

Please also try to answer these two questions, which we will cover, along with others, in the "live" lecture.

1. Calculate the minimum force needed for plastic flow of the basal <a> slip system in a single Zr crystal, as shown here. The crystal has been shaped into a rod with diameter 3 mm and length 50 mm, and the tensile axis is aligned along the [021] direction. The CRSS for basal <a> slip in Zr is 204 MPa. The c/a ratio in Zr is 1.593.



2. What is the minimum force once the crystal has been extended by 50% (75 mm)?

   Note, volume conservation will be maintained such that $l_0 d_0^2 = l_1 d_1^2$ *and geometry of the slipped crystal changes according to* $l_0 cos\,\phi_0 = l_1 cos\,\phi_1$ *and* $l_0 sin\,\lambda_0 = l_1 sin\,\lambda_1$ *(where* l_0*,* d_0 *and* l_1*,* d_1 *are the length and diameter before/after extension,* ϕ_0*,* λ_0 *and* ϕ_1*,* λ_1 *are crystal alignments with the tensile axis before/after extension).*