DEFORMATION PROCESSING OF ANISOTROPIC METALS.

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by D. H. Avery and W. A. Backofen.

[redacted]
Metals Processing Lab[redacted]., Mass. Inst. of Tech.,
Cambridge, [redacted]

DEFORMATION PROCESSING OF ANISOTROPIC METALS

D. H. Avery and W. A. Backofen

During the past report period elevated-temperature tensile tests have been carried out on the alloy Zircaloy 4. As in the case of the Ti alloy 2.5 Sn-4 Al ~~(Report No. 1)~~, a very sharp maximum in strain rate sensitivity, m, was found at or near the α-β transus, ~~Figure 1.~~ Elongation values, ~~Figure 2,~~ again correlated with strain rate sensitivity; however the maximum value of 220% was not as striking as in the titanium alloy.

Values of strain ratio, R, were high in Zircaloy 4 (approximately 4 at RT) and decreased with increasing testing temperature. For temperatures below 600°C, R was relatively constant with strain. In the range 600° to 800°C, R was found to increase remarkably after the onset of necking. In this temperature range necking occurred only in the width direction, leading to chisel-edged fractures showing 100% reduction in width and R values approaching infinity.

A sheet of HPS-20, cross-rolled sintered beryllium has been ordered. This material should be characterized by strong anisotropy with [0002] along the sheet normal and high R values. One of the principle problems in beryllium technology lies in the very limited bend ductility at ordinary temperatures. Since sheet bending is a plane-strain operation, high R values and plane strain strengths would naturally be expected to impair ductility. Temperature dependence of deformation in plane strain will be of immediate experimental concern.

-1-

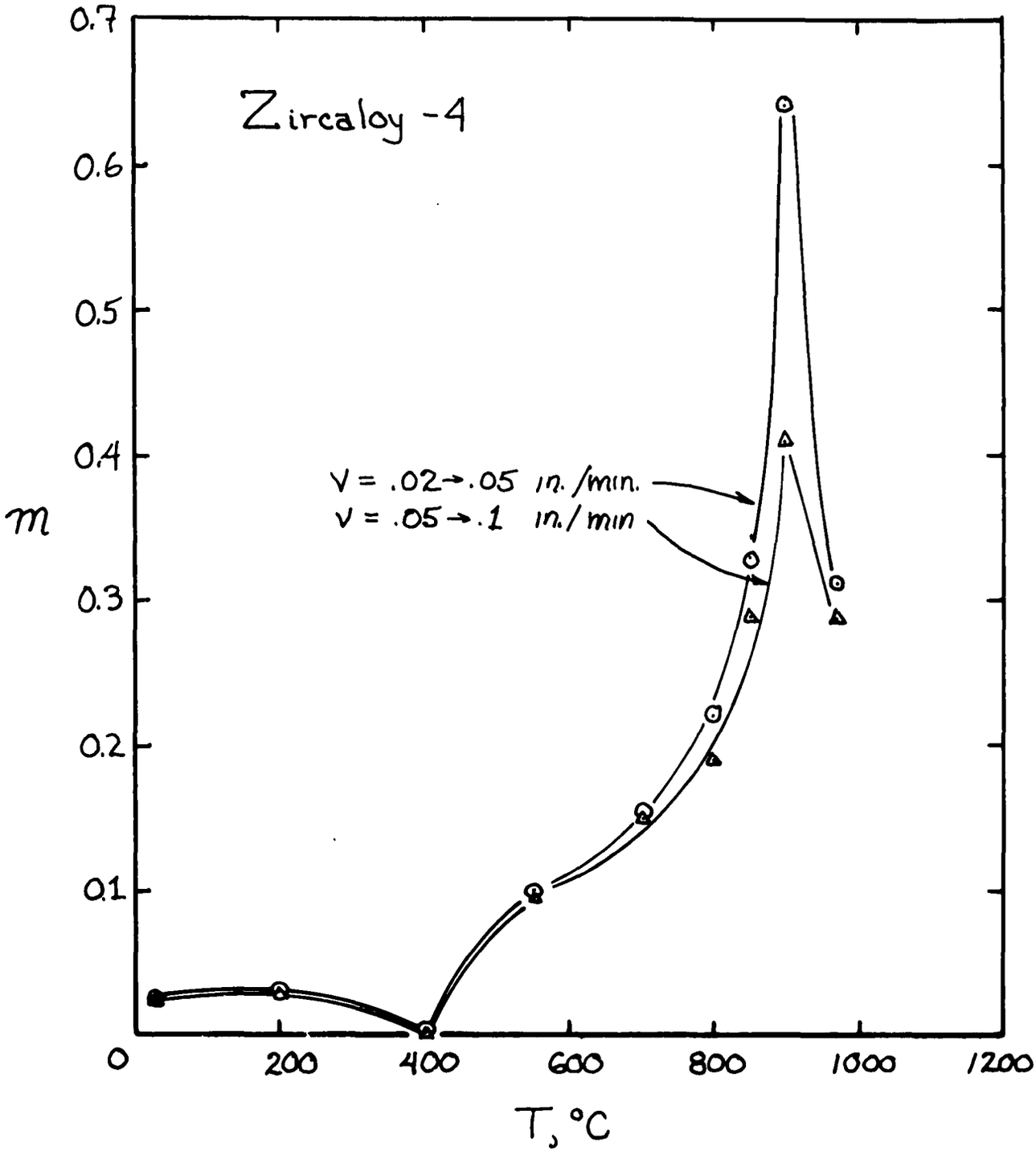

Figure 1. Strain Rate Sensitivity, m, Values versus Temperature for Zircaloy 4 at Two Pulling Velocities. m is the exponent in the empirical expression $\sigma = k\epsilon^m$.

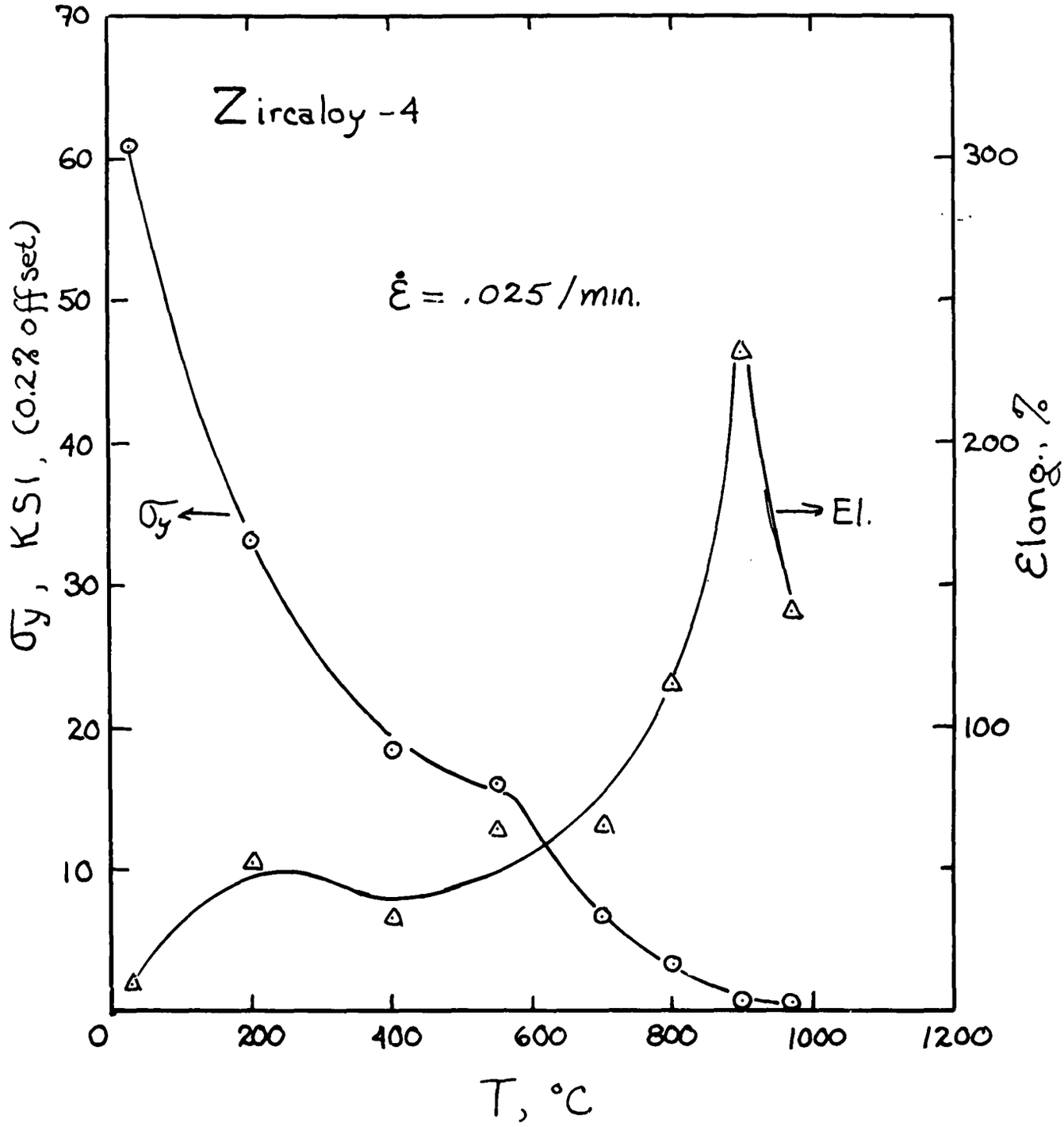

Figure 2. 0.2% Offset Yield Strength and Percent Elongation versus Temperature for Zircaloy 4. $\dot{\epsilon} = 0.025\ min^{-1}$.

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