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Abstract: Recent advances in spherical indentation stress-strain protocols and analyses have demonstrated the capability for measuring reliably the local mechanical responses in polycrystalline metal samples at different length scales, ranging from sub-micron (regions within individual grains) to several hundreds of microns (regions covering several grains). These recent advances have now made it possible to study systematically the mechanical behavior of a single material system at different length scales, with tremendous potential to obtain new insights into the role of individual phases, interfaces, and other microscale constituents on the macroscale mechanical response of the material. In this paper, we report spherical indentation stress-strain measurements with different indenter sizes (microns to millimeters) on Ti-6Al-4V (Ti-64) which capture the mechanical response of single phase alpha-Ti-64, single colony (alpha-beta), few colonies, and many colonies of Ti-64. The results show that the average mechanical response (indentation modulus and yield strength) from multiple indentations remains relatively unchanged from single phase alpha to many colonies of Ti-64, while the variance in the response decreases with indenter size. The work-hardening response in indentation tests follows a similar