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The elastic constants of zinc are compiled and reviewed; one hundred references are cited. The included elastic constants are: Young's modulus, shear modulus, bulk modulus, compressibility, Poisson's ratio, second-order single-crystal elastic stiffness and compliances, and third-order elastic stiffness. Temperature and elastic-anisotropy effects are also reviewed. Other topics are: sound velocities, elastic Debye temperatures, Cauchy relationships, elastic stability, pressure effects, and theoretical studies. New polycrystalline data are computed from single-crystal data by means averaging methods.

Key words: Bulk modulus; compressibility; Debye temperature; elastic constants; Poisson's ratio; shear modulus; single-crystal elastic coefficients; sound velocities; Young's modulus; zinc.

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1. Introduction

Previous reports in this series discussed elastic properties of iron, nickel, and iron-nickel alloys [1]¹ and copper [2]. Reference 1 also discusses some solid-state-elasticity concepts that are relevant here, including: crystal physics and thermodynamics; temperature effects; relationships between elastic constants and other physical properties, especially the elastic Debye temperature; and relationships between single-crystal and polycrystal elastic constants.

The purpose here is to present a compilation and a review of elastic properties of zinc. One hundred scientific and engineering publications are cited. Both single-crystal and polycrystal elastic constants are considered together with effects of familiar metallurgical variables on the constants.

Zinc is used widely technologically. Some better-known applications include: galvanized iron and steel, die cast-

ings, solders, and alloys. Brasses (zinc-copper alloys) are perhaps the best-known and most useful zinc alloys. Properties and applications of both zinc and its alloys are summarized elsewhere [3].

The first reasonably comprehensive review of anisotropic elastic-constant measurements, by Hearman [4] in 1946, cited only three hexagonal metals: cadmium, magnesium, and zinc. But, hexagonal-metal elastic-property studies have proliferated in recent years. Hearman's [5] more recent review in 1969 cites sixteen hexagonal metals. Except for magnesium, and perhaps beryllium, zinc has received more experimental study than other hexagonal metals. Magnesium has been studied extensively theoretically because its axial ratio is nearly ideal and because it is nearly elastically isotropic. As discussed below, a nonideal axial ratio and a high elastic anisotropy make zinc studies more interesting but also more difficult.

2. Zinc as a Metal

Zinc seems at first to be a relatively simple metal with a relatively low atomic number (thirty). Its electronic

¹ Figures in brackets indicate literature references at the end of this paper.

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Patrick Vollmar



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