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Some Properties of the Alloys Au-Cd, $Au_xCu_{53-x}Zn_{47}$, and Au-Ni

Fae'q A. A. Radwan
Faculty of Engineering, Near East University
K. K. T. C Lefkosa P.O. Box: 670 Mersin - 10 Turkey

Abstract: The norm concept of elastic compliance tensor and its irreducible parts and their ratios are used to study the anisotropy of the alloys Au-Cd at different percentages of Cd at different temperatures, $Au_xCu_{53-x}Zn_{47}$ for different values of x and Au-Ni at different percentages of Ni is given.

Key Words: Properties, Decomposition, Norm, Anisotropy, and Elastic Compliance

Introduction

The decomposition procedure and the decomposition of elastic constant and elastic compliance tensors is given in (Radwan, 2001), also the definition of norm concept and the norm ratios and the relationship between the anisotropy and the norm ratios are given in (Radwan, 2001). As the ratio N_s / N becomes close to one the materials becomes more isotropic, and as the ratio N_n / N becomes close to one the materials becomes more anisotropic as explained in (Radwan, 2001).

Table 1: Elastic Compliance $(TPa)^{-1}$ (Bornstein).

Alloy, Cubic System	s_{11}	s_{12}	s_{44}
Au-Cd, at % Cd			
50, 323K	84.5	-40.6	22.9
47.5, 333K	115.8	-56.3	24.6
47.5, 323K	112.4	-54.5	23.6
$Au_xCu_{53-x}Zn_{47}$, at x			
0	38.0	-17.5	12.7
15	43.4	-20.3	14.2
20	56.5	-26.9	16.6
23	75.0	-36.1	18.0
30	75.0	-36.1	17.2
45	80.2	-13.3	17.2
53	57.4	-27.4	19.2
Au-Ni, at % Ni			
0	23.3	-10.7	23.8
2.95	22.9	-10.5	23.3
9.72	21.9	-10.0	22.2
24.2	18.4	-8.2	19.6
42.42	16.0	-7.0	16.2

By using Table 1, and the decomposition of the elastic compliance tensor (Radwan, 2001), we calculated the norms and norm ratios as in Table 2.

Table 2: The Norms and Norm Ratios

Alloy, Cubic System	N_s	N_d	N_n	N	N_s / N	N_d / N	N_n / N
Au-Cd, at % Cd							
50, 323K	212.963	0	184.66	281.87	0.7555	0	0.6551
47.5, 333K	285.207	0	259.64	385.69	0.7395	0	0.6732
47.5, 323K	276.305	0	252.01	373.97	0.7388	0	0.6739
$Au_xCu_{53-x}Zn_{47}$, x (at %)							
0	97.3667	0	79.859	125.93	0.7732	0	0.6342
15	111.312	0	91.964	144.39	0.7709	0	0.6369
20	143.481	0	122.02	188.35	0.7618	0	0.6478
23	186.505	0	165.89	249.61	0.7472	0	0.6646
30	185.607	0	166.54	249.37	0.7443	0	0.6678
45	168.024	0	137.95	217.40	0.7729	0	0.6345
53	148.492	0	122.19	192.30	0.7722	0	0.6354
Au-Ni, at % Ni							
0	77.6252	0	35.908	85.528	0.9076	0	0.4198
2.95	76.1664	0	35.340	83.966	0.9071	0	0.4209
9.72	72.6878	0	33.796	80.160	0.9068	0	0.4216
24.2	61.8445	0	27.297	67.601	0.9148	0	0.4038
42.42	52.6457	0	24.210	57.945	0.9085	0	0.4178

Conclusion

From Table (2) we conclude the following:

- For the Alloy Au-Cd, at the same temperature as the percentage of Cd increases the anisotropy of Au-Cd increases, and for the same percentage of Cd as the temperature increases the anisotropy decreases.
- For the Alloy $Au_xCu_{53-x}Zn_{47}$ as x (at %) increases up to 30 the anisotropy increases but for $x = 45$ (at %) the anisotropy decreases after this for $x = 50$ (at %) the anisotropy increases again.
- For the Alloy Au-Ni as the percentage of Ni increases the anisotropy increases but for the percentage of Ni equal 42.42 the anisotropy decreases.

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