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Some Properties of Triclinic System Materials

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Abstract

The norm of elastic constant tensor and the norms of the irreducible parts of the elastic constants of the triclinic system materials (Ammonium Tetroxalate Dehydrate, $NH_4H_3(C_2O_4)_2.2H_2O$, Copper Sulfate Pentahydrate, $CuSO_4.5H_2O$ and Potassium Tetroxalate Dehydrate, $KH_3C_2O_4.2H_2O$) were calculated. The relation of the scalar parts norm and the other parts norms and the anisotropy of these materials were presented. The norm ratios were used as a criterion to present the anisotropy degree of the properties of these materials.

Key words: Norm, Anisotropy, Elastic Constant, Irreducible, and Triclinic System.

1. Introduction

The decomposition procedure and the decomposition of elastic constant tensor (Elastic constant tensor can be decomposed into two scalar parts, two deviator parts and one nonor part) is given in [1-4], also the definition of norm concept and the norm ratios and the relationship between the anisotropy and the norm ratios are given in [1-4]. As the ratio N_s /N (Norm of the scalar part of the elastic constant tensor/Norm of the elastic constant tensor) becomes close to one, the material becomes more isotropic, and as the sum of the ratios N_d/N (Norm of the deviator part of the elastic constant tensor/Norm of the elastic constant tensor) and N_n/N (Norm of the nonor part of the elastic constant tensor/Norm of the elastic constant tensor) becomes close to one, the material becomes more anisotropic as explained in [1-4]. In this study, I have attempted to predict some properties of triclinic system materials.

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2. Experimental

2.1. Data and Calculations

The elastic constants of Triclinic System Materials are given in the following table,

Table 1. Elastic constants in GPa [5].

Material / Elastic Constants	Ammonium Tetroxalate Dihydrate, $NH_4H_3(C_2O_4)_2.2H_2O$	Copper Sulfate Pentahydrate, $CuSO_4.5H_2O$	Potassium Tetroxalate Dihydrate $KH_3C_2O_4.2H_2O$
c_{11}	21.9	57.1	25.4
c_{12}	12.0	20.6	11.8
c_{13}	10.4	31.6	9.83
c_{14}	1.6	-4.3	0.72
c_{15}	6.0	-0.4	6.12
c_{16}	-1.0	-2.2	-1.23
c_{22}	45.9	35.8	47.8
c_{23}	16.3	23.4	14.0
c_{24}	11.6	-2.8	11.3
c_{25}	2.0	-0.1	1.46
c_{26}	-3.8	-0.6	-2.70
c_{33}	36.4	58.4	34.3
c_{34}	3.8	-0.8	2.19
c_{35}	2.0	-2.8	1.47
c_{36}	-0.8	-0.8	0.40
c_{44}	10.4	16.5	10.2
c_{45}	0.1	-1.8	-0.82
c_{46}	0.1	1.2	0.53
c_{55}	5.40	15.2	5.69
c_{56}	0.1	-3.5	0.70
c_{66}	4.44	12.0	4.99

By using table 1 and the decomposition of the elastic constant tensor and the norm concept, we can calculate the norms and the norm ratios of the given materials as shown in the table 2.

Table 2. The norms and norm ratios (the anisotropy degree).

Material	N_s	N_d	N_n	N	N_s/N	N_d/N	N_n/N
Ammonium Tetroxalate Dihydrate, $NH_4H_3(C_2O_4)_2.2H_2O$	66.6570	19.0088	8.4639	69.8293	0.9546	0.2722	0.1212
Copper Sulfate Pentahydrate, $CuSO_4.5H_2O$	110.7165	21.3583	5.7562	112.9047	0.9806	0.1892	0.0510
Potassium Tetroxalate Dihydrate $KH_3C_2O_4.2H_2O$	66.5966	17.0322	9.8219	69.4383	0.9591	0.2453	0.1414

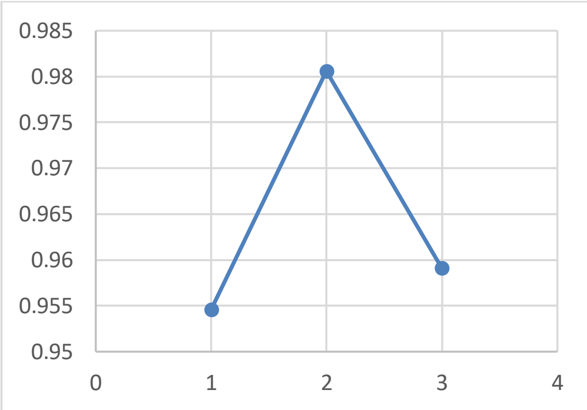

Figure 1. Isotropy Degree.

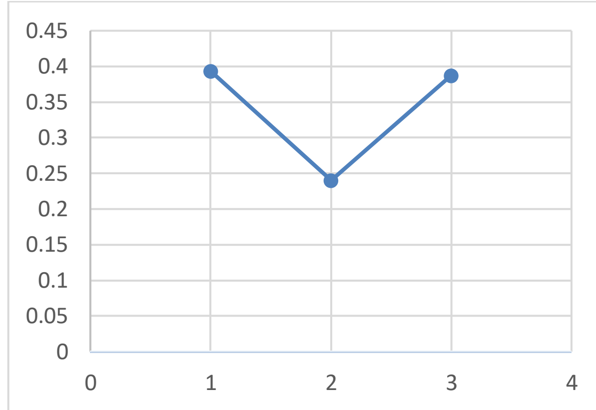

Figure 2. Anisotropy Degree.

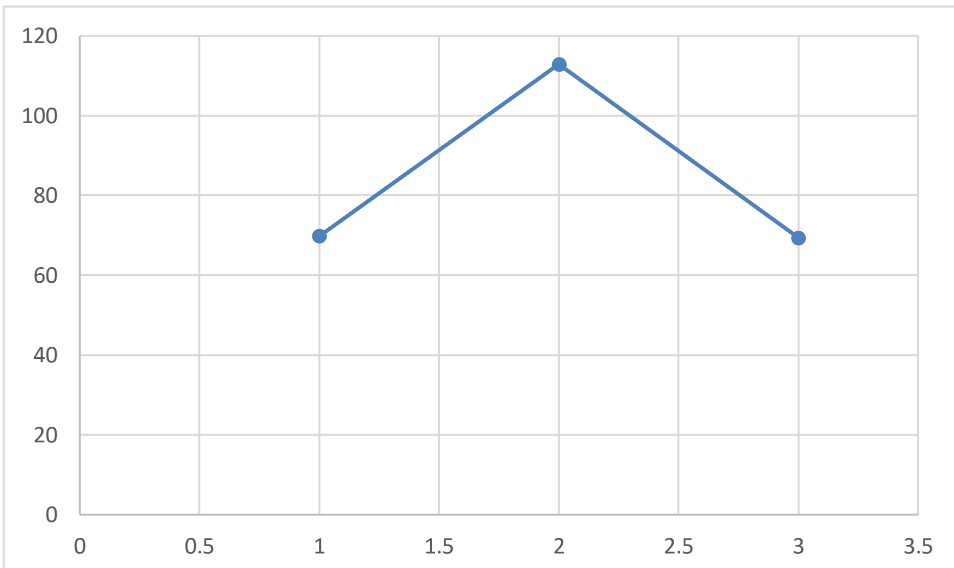

Figure 3. Elastically Strong.

3. Results and Conclusion

From the table 2, Figure 1-3 and analyzing the ratio N_s/N, we can conclude that **Copper Sulfate Pentahydrate, $CuSO_4.5H_2O$** is the most isotropic material with highest value of N_s/N (0.9806) and lowest sum value of N_d/N and N_n/N (0.2402), **Ammonium Tetroxalate Dihydrate, $NH_4H_3(C_2O_4)_2.2H_2O$** is the most anisotropic material with highest sum value of N_d/N and N_n/N (0.3934) and with lowest value of N_s/N (0.9546), because for isotropic material $N_s/N = 1$, and $N_d/N = 0$ and $N_n/N = 0$. It indicates that increase in the values of N_d/N and N_n/N is also increases the anisotropy (values of N_d/N and N_n/N are directly proportional to the anisotropy) and elastically strongest material is **Copper Sulfate Pentahydrate, $CuSO_4.5H_2O$**, which has the highest value of **N** (112.9047).

4. Conflicts of Interest

The author(s) report(s) no conflict(s) of interest(s). The author along are responsible for content and writing of the paper.

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