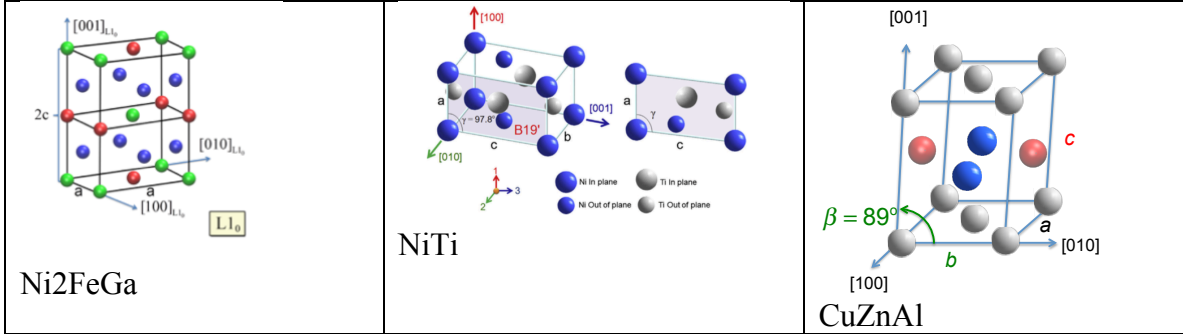


TAM 524- Homework #1

Name \_\_\_\_\_  
 Due February 4, 2019

Based on the results of elastic moduli given below, please determine (i) the elastic moduli along [001], [010] and [100] directions. Then, determine the shear moduli in the following directions: (ii) {011}<100> direction for NiTi, (iii) {111}<112> direction for Ni<sub>2</sub>FeGa, and (iv) {112}<111> direction for CuZnAl.



Using the Voigt's notation, the double indices can be replaced with a single indice ( $11 \rightarrow 1; 22 \rightarrow 2; 33 \rightarrow 3; 23 \rightarrow 4; 13 \rightarrow 5; 12 \rightarrow 6$ ). Then the second-order stress tensor can be expressed with a vector as  $\sigma = (\sigma_1, \sigma_2, \sigma_3, \sigma_4, \sigma_5, \sigma_6)$ , and the second-order strain tensor can be written as  $\epsilon = (\epsilon_1, \epsilon_2, \epsilon_3, \epsilon_4, \epsilon_5, \epsilon_6)$ . Then, we have

$$\sigma_i = C_{ij} \epsilon_j, (i, j = 1, 2, 3, 4, 5, 6)$$

$$\epsilon_i = S_{ij} \sigma_j, (i, j = 1, 2, 3, 4, 5, 6)$$

Elastic constants (in GPa) and the corresponding crystal structures of alloys Ni<sub>2</sub>FeGa, NiTi and CuZnAl in martensitic phase are given below.

Alloys	Crystal Structure	C <sub>11</sub>	C <sub>22</sub>	C <sub>33</sub>	C <sub>44</sub>	C <sub>55</sub>	C <sub>66</sub>	C <sub>12</sub>
Ni <sub>2</sub> FeGa	L1 <sub>0</sub>	256	256	212	109	109	45	103
NiTi	B19'	209	234	238	77	23	72	114
CuZnAl	18R	175	156	235	54	28	48	118

C <sub>13</sub>	C <sub>15</sub>	C <sub>23</sub>	C <sub>25</sub>	C <sub>35</sub>	C <sub>46</sub>
155	0	155	0	0	0
102	1	139	-7	27	-5
40	10	150	~0	~0	-10