

FAQ's TO FERROPERM PIEZOCERAMICS

QUESTION

What is the Young's modulus of Ferroperm Piezoceramic materials?

ANSWER:

In any piezoelectric material there is not only 1 but 4 different Young's moduli.

This is first of all because piezoelectric materials are anisotropic, and therefore behaves differently in the thickness and planar directions.

Secondly Young's module in piezoceramics is also dependent on the external conditions. The material will thus react differently depending if it is short-circuited (superscript E) or in an electrical open condition (superscript D)

Generally the Young's modulus can be calculated as the inverse value of the elastic compliance parameter, "s".

The four different types of Young's moduli are therefore:

$$Y_{11}^E = 1/s_{11}^E \quad \text{Planar direction, short-circuit condition}$$

$$Y_{33}^E = 1/s_{33}^E \quad \text{Thickness direction, short-circuit condition}$$

$$Y_{11}^D = 1/s_{11}^D \quad \text{Planar direction, electrically open condition}$$

$$Y_{33}^D = 1/s_{33}^D \quad \text{Thickness direction, electrically open condition}$$

The elastic compliance data can be found on Ferroperm's Internet page at www.ferroperm-piezo.com, and Young's moduli can be calculated as follows

| Type | Unit | Pz21 | Pz23 | Pz24 | Pz26 | Pz27 | Pz28 | Pz29 | Pz34 | Pz46 |
|------------|------|------|------|------|------|------|------|------|------|------|
| Y_{11}^E | GPa | 55 | 68 | 96 | 77 | 59 | 79 | 59 | 136 | 94 |
| Y_{33}^E | GPa | 56 | 52 | 73 | 51 | 43 | 55 | 44 | 137 | 23 |
| Y_{11}^D | GPa | 61 | 74 | 105 | 86 | 66 | 90 | 68 | 137 | 94 |
| Y_{33}^D | GPa | 107 | 88 | 130 | 96 | 84 | 104 | 101 | 162 | 23 |