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Comparisons of the dynamic moduli of various polymers

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To fully characterise the elastic properties of a homogeneous, isotropic material, two independent elastic constants are needed, usually the bulk and shear moduli. For the types of polymers used in sonar applications, these moduli are typically both frequency and temperature dependent. Of particular interest is the position (in frequency and temperature) of peak loss tangent, which is related to the glass transition temperature through the free volume concept. Although there exists in the literature a lot of data on the dynamic shear (and Young's) modulus for various polymers, data on dynamic bulk modulus is scarcer, due to the difficulty of the measurement. This paper reviews the current literature on the dynamic moduli of various polymers, with particular regard to the relationship between the peak loss tangents of the bulk and shear moduli. Simple relaxation models are studied to give insight on the factors affecting the peak of the loss tangent and new measurements on a nitrile-butadiene rubber compound are presented.