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Estimates of internal friction by Sompi spectral analysis for resonant sphere spectroscopy

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The Reasonant Sphere Technique (RST) is a powerful tool to measure elastic and anelastic properties of a solid sample. In RST, free oscillations of the sample are excited by impulsive input, and the output waveform data are acquired as a function of time(FT method). Generally, the resonant spectrum has been obtained by spectral analysis using Fast Fourier Transform (FFT) in which the degree of dissipation of the vibration energy (internal friction) is measured by the broadening of the resonance peaks. As reported in the previous conference of the Japan Geosience Union Meeting (Yamamoto et al., 2011), we applied the Sompi method to RST data and determined elastic moduli and internal friction. Yamamoto et al. (2011) concluded that internal friction $Q_{12}{}^{-1}$ of a single crystal MgO by the Sompi spectral analysis demonstrates positive value although our FFT analysis as well as previous works (Sumino et al., 1976; Oda et al., 1994) showed negative values. This suggests that the Sompi analysis for RST may be more effective than FFT technique for estimates of internal friction values. However, we found the strong dependence of internal friction values on the number of modes used for the estimates of internal friction. We acquired the waveform data by changing the force holding the specimen in order to extrapolate to zero-force. The data were analysed by both FFT and Sompi methods, and frequencies and half-widths (FFT)/decaying rates (Sompi) at zero-force were estimated. The modes with enough amplitude and good reproducibility were selected, and the internal friction parameters were estimated according to Sumino et al.(1976). The results show that the errors in internal friction determined using both FFT and Sompi method become smaller than those reported by Yamamoto et al. (2011). The present study suggests that Sompi analysis may be more effective to estimate internal friction.

Keywords: Reasonant Sphere Technique, Sompi method, internal friction, elastic constant