RAMAN SPECTRA OF FERROELECTRIC SOFT MODE IN SrTiO₃


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Temperature dependence of Raman spectra of the ferroelectric mode were measured in an isotope substituted SrTi₁₈O₃ crystal, which undergoes a ferroelectric transition at Tₖ = 23 K [1]. The lowest zone center mode F₁₆(Γ) in the cubic phase splits into A₂ₑ⁺Eₑ modes in the tetragonal phase and the Eₑ mode is the incipient ferroelectric mode in SrTi₁₆O₃. Below the structural phase transition at 105 K, an external electric field significantly increases the Raman intensity of the ferroelectric Eₑ mode in SrTi₁₆O₃ indicating that this mode couples strongly with the A₁g mode which is folded from the zone-boundary F₂ᵤ(R) mode. [2] In the ferroelectric phase of SrTi₁₈O₃, the Eₑ mode will split and become Raman active A₁+B₁(or B₂) modes. The observed spectra below Tₖ show several peaks which are not observed above Tₖ and one of those peaks softens from 12cm⁻¹ at 8 K down to about 5cm⁻¹ at Tₖ. The existence of the soft mode suggests that the ferroelectric transition in SrTi₁₈O₃ is not an impurity or stress induced one but intrinsic in nature. In the ferroelectric phase, the electric field seems to reduce the Raman intensity.