

# Absolute Determination of Optical Properties of InSb by using Reflection Electron Energy Loss Spectroscopy

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**EXTENDED ABSTRACT:** The energy loss function (ELF) of a narrow bandgap semiconductor, InSb, was derived from the reflection electron energy loss spectroscopy (REELS) spectrum measured at 4 keV incident electron energy. The experimental spectrum was analyzed with the reverse Monte Carlo (RMC) method, which combines the classical trajectory Monte Carlo simulation with the simulated annealing method for optimization of trial ELF. The complex dielectric function, the refractive index and the extinction coefficient were then determined from the obtained ELF in the energy loss (i.e. photon energy) region below 200 eV. The validity of the obtained optical constants was verified with ps-sum rule, f-sum rule, inertial sum rule and dc-conductivity sum rule.

**Keywords:** optical constants, Indium antimonide, reverse Monte Carlo, reflection electron energy loss spectroscopy

## REFERENCES

[1] B. Da et al. *Journal of Applied Physics*, **113(21)**, (2013)214303.

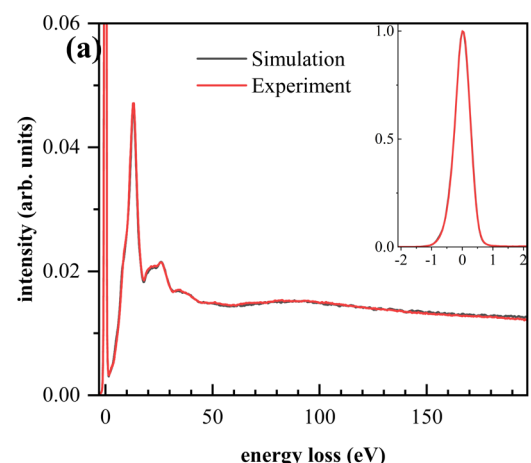
[2] L. H. Yang et al. *Physical Review B*, **100(24)**, (2019) 245209.

[3] H. Xu et al. *Physical Review B*, **95(19)**, (2017) 195417.

## BIOGRAPHY



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**Figure 1.** The REELS spectra and ELF of InSb.

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