# Charge Transport, Band Structure Engineering, And Reliability Of Electronic Materials In Bangladesh

**Zawad Abrar Rafi**[1],MstMourimaAkter[1*],Sm Walid[1],Md Mushfiqur Rahaman Taip[1], , Tanvir Rahman Hamim[1];Koushik Biswas Arko[2]And Md. Mortuza Ahmmed[2]

[1]*Undergraduate Student, Department of Computer Science, American International University -Bangladesh, Dhaka, Bangladesh,*

[1]*Undergraduate Student, Department of Electrical and Electronics Engineering, American International University -Bangladesh, Dhaka, Bangladesh*

[2]*Associate Professor, Department of Mathematics, American International University-Bangladesh, Dhaka, Bangladesh, mortuza@aiub.edu*

Corresponding Author: *22-47089-1@student.aiub.edu*

**Introduction:** The rapid advancement of electronic materials in Bangladesh necessitates rigorous longitudinal analysis to understand technological progress. This study examines the thirty-year trajectory (1995 - 2024) of semiconductor quality, concentrating on charge mobility, band gap regulation, and device reliability, to underscore data-driven improvements in material efficiency and stability.

**Methodology:** This research analyzed a secondary dataset using Python libraries, specifically Pandas and NumPy for rigorous statistical evaluation and Matplotlib for data visualization, The study was based on charge transport and defect recombination trends sourced from APS and IEEE semiconductors studies to evaluate long-term data-driven improvements in material efficiency and device stability from 1995 to 2024.

**Result:**

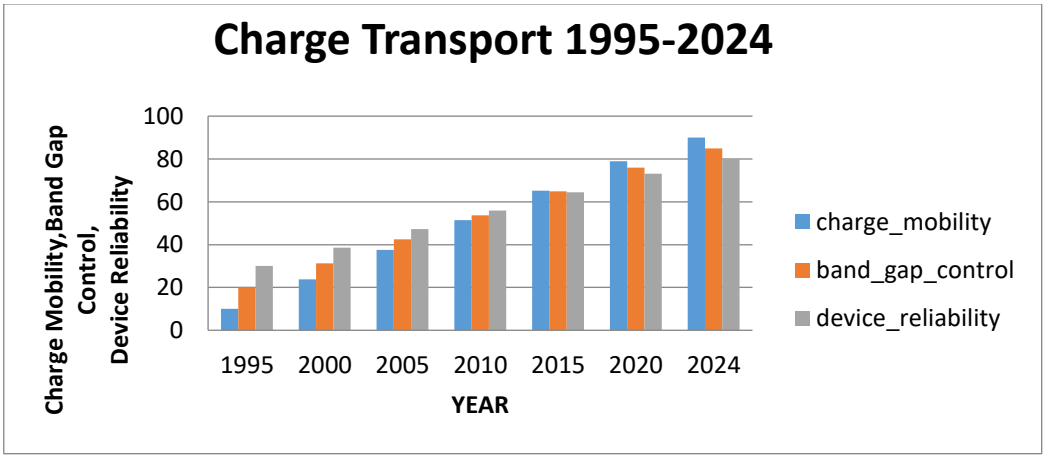


**Fig: Charge Mobility, Bandgap Control, device-reliability VS Year(1995 - 2024) plotting**

The quantitative examination of secondary data from 1995 to 2024 demonstrated a completely symmetrical distribution across all observations, as evidenced by a skewness coefficient of zero. Throughout this thirty-year span, charge mobility demonstrated the widest dynamic range, fluctuating from a low of 10 to a maximum of 90, with both the mean and median precisely at 50. Consistently a uniform linear trend was noted in other critical semiconductor metrics, with band gap control rising from a minimum of 20 to a high of 85, and device reliability advancing steadily from an initial value of 30 to a peak of 80.

**Conclusion:** The statistical data from 1995 to 2024- highlighted by skewness), perfectly centered averages (50) for charge mobility, and consistent growth up to maximums of 90, 85, and 80 across key metrics- demonstrates a uniform, sustained progression in semiconductor quality. These numerical trends validate a “Golden Era” of technological maturity, confirming that data-driven methodologies successfully drive continuous and sustainable enhancements in electronic materials.

**Keywords: Semiconductors, Charge Mobility, Band gap control, device reliability.**

**References:**

**1.**Ding, Z., Li, C., Da, B., & Liu, J. (2021b). Charging effect induced by electron beam irradiation: a review. Science and Technology of Advanced Materials, 22(1), 932-971. https://doi.org/10.1080/14686996.2021.1976597

**2.**Zhu, J., Pan, Y., & Wen, M. (2026). Band gap engineering of monolayer β-$Ga_2O_3$: Band gap modulation and UV photon manipulation via III/IV main group single-atom doping. Materials Today Chemistry, 52, 103395.https://doi.org/10.1016/j.mtchem.2026.103395