High Efficiency Double Perovskites for Energy Storage Applications: Sr-Doped Sm_2MgMnO_6

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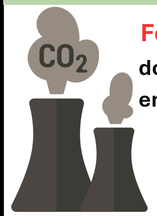
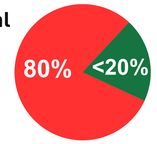
Introduction and Motivation

Global Energy Challenge



Fossil Fuels
dominates global energy use



Solar & Wind
growing rapidly but intermittent

Efficient energy storage systems are essential for sustainable future.

Why Dielectric Capacitors?

Batteries:
High energy density
but slow charge discharge

Dielectric Capacitors:
Fast Charge/Discharge ,
High power density

Why Double Perovskites?

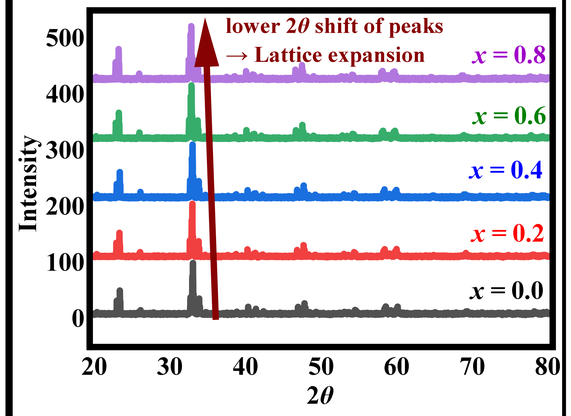
- ✓ $A_2BB'O_6$ type double perovskite structure
- ✓ Allows easy A-site substitution
- ✓ Lattice distortion may influence oxygen vacancies
- ✓ Tunes ε_r, tan δ, and optical bandgap - energy storage.

Composition Series

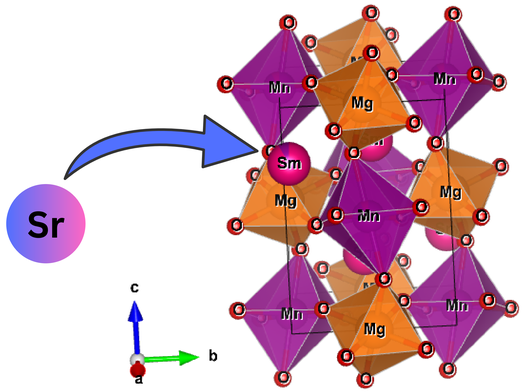
$Sm_{2-x}Sr_xMgMnO_6$ (x = 0.0 , 0.2, 0.4, 0.6, 0.8)

Findings and Interpretations

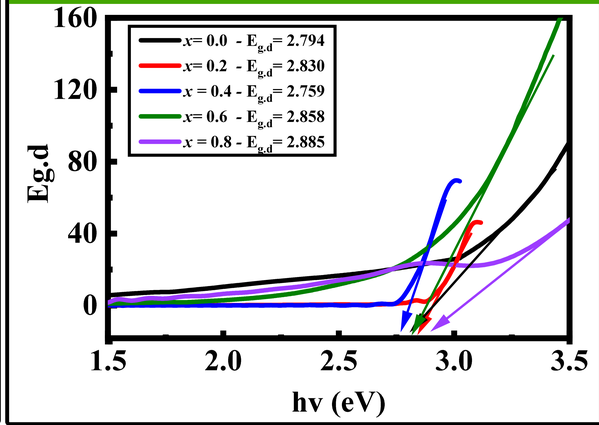
(A) XRD RESULTS



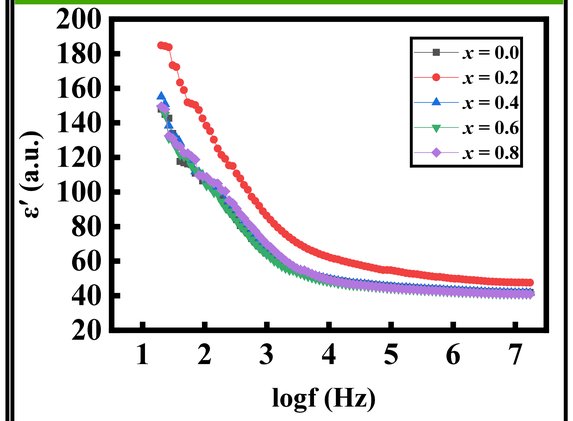
(B) Sr SUBSTITUTION ON A-SITE



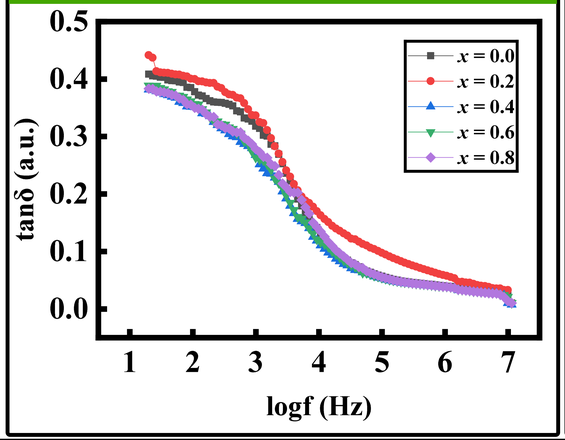
(C) TAUC-PLOT - BANDGAP



(D) DIELECTRIC CONSTANT, ε′ VS LOG f



(E) DIELECTRIC LOSS, tan δ VS LOG f



(F) CONCLUSION

1. Sr doping induces lattice expansion, confirmed by lower 2θ peak shift.
2. x = 0.2 shows the highest dielectric constant, but also higher loss.
3. Other compositions show moderate ε' with lower tan δ, suitable for dielectric energy-storage studies.
4. Future work: breakdown strength, recoverable energy density and cycling stability.

This work supports:
SDG 7 (Affordable and Clean Energy) and SDG 12 (Responsible consumption and production)