Structural and Electrical Characteristics of the $Al/Al_2O_3/SiO_2/n\text{-}Si$ Metal-Oxide-Semiconductor capacitor

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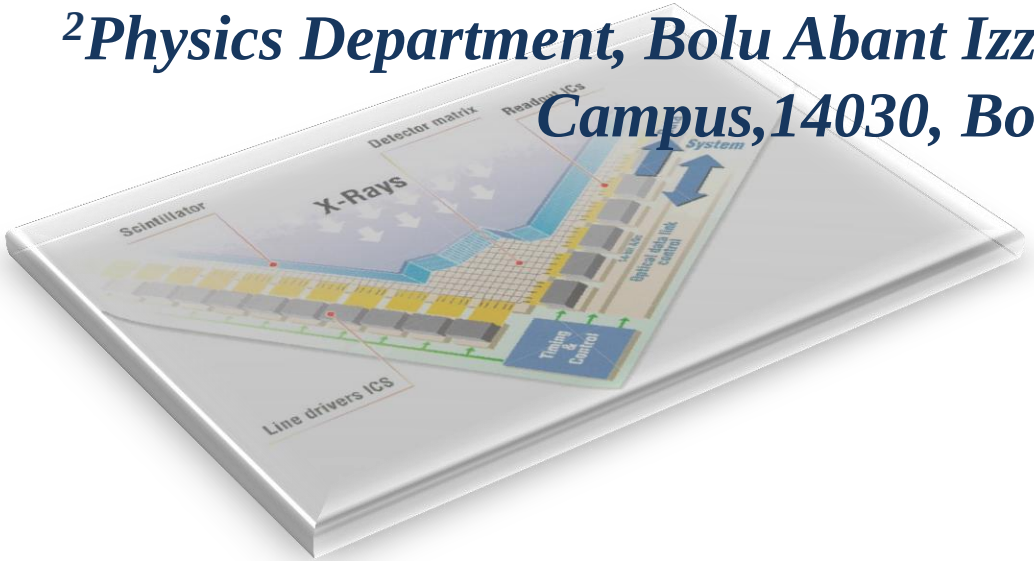
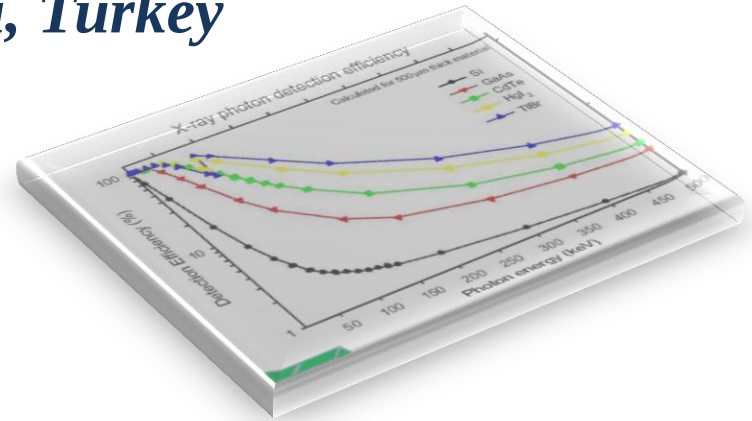
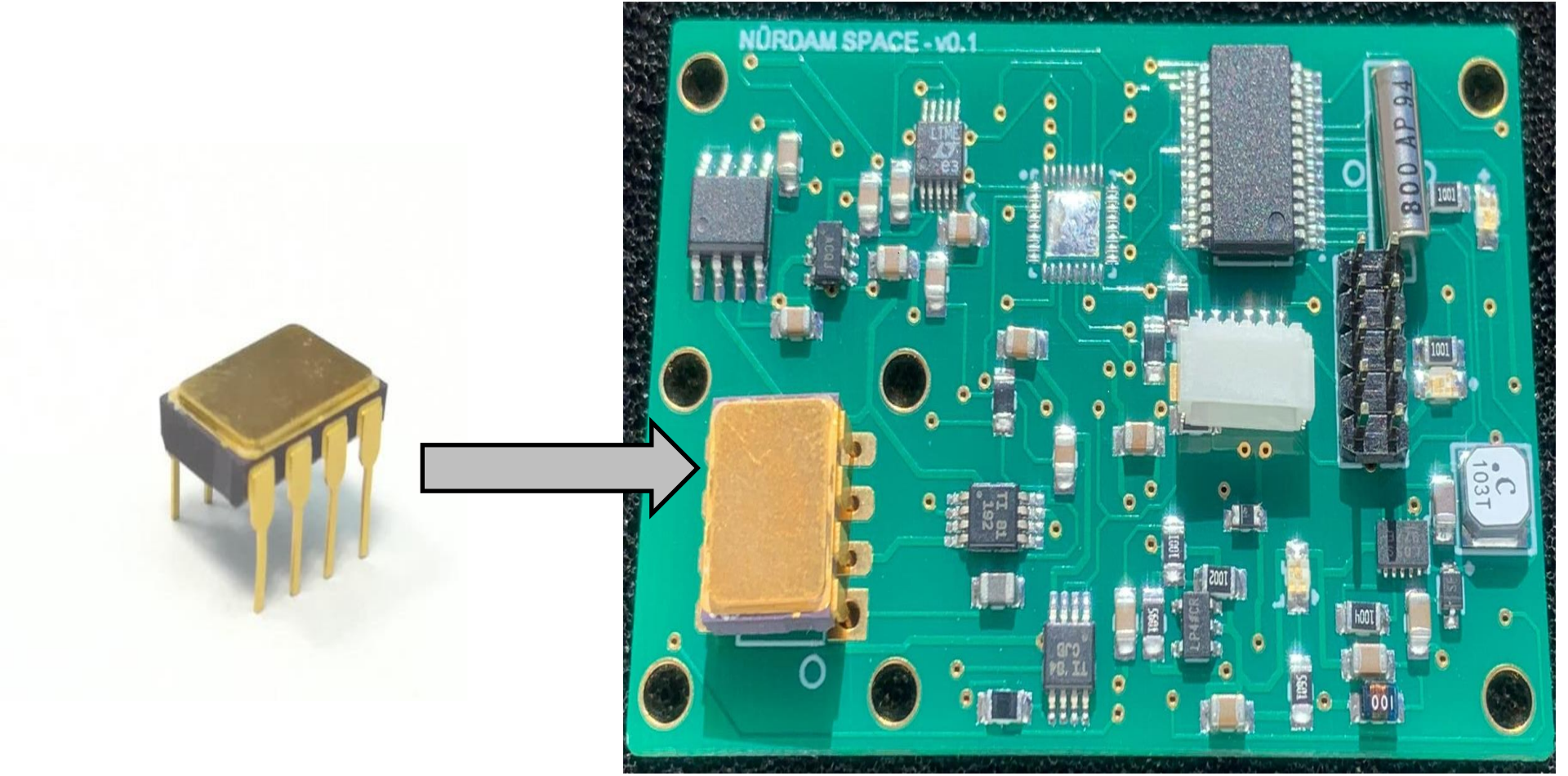
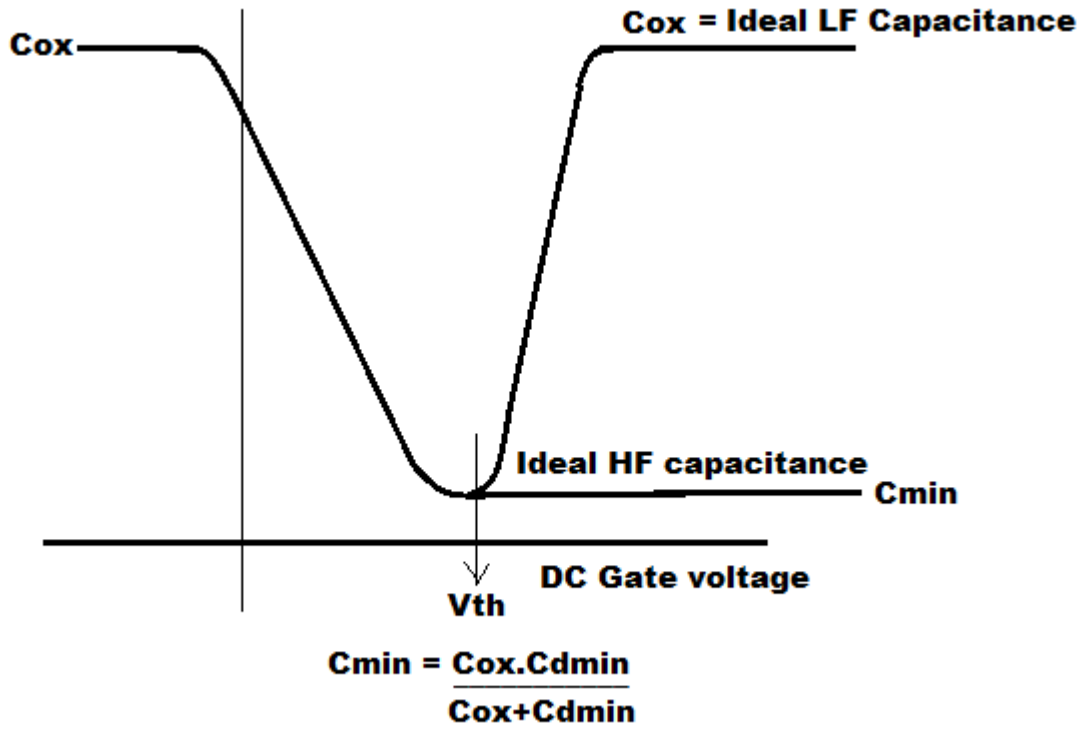




INTRODUCTION



A MOS based Field-Effective –Transistor (FET) for space applications fabricated at Nuclear Radiation Detectors Applications and Research Center



C-V (capacitance-voltage) plots for an ideal MOS structure [1].

EXPERIMENT

RCA cleaning of n-type Silicon wafers

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SiO_2 Growth

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Deposition of Al_2O_3

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Post oxide deposition annealing

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X-ray diffraction measurements

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Metallization Process

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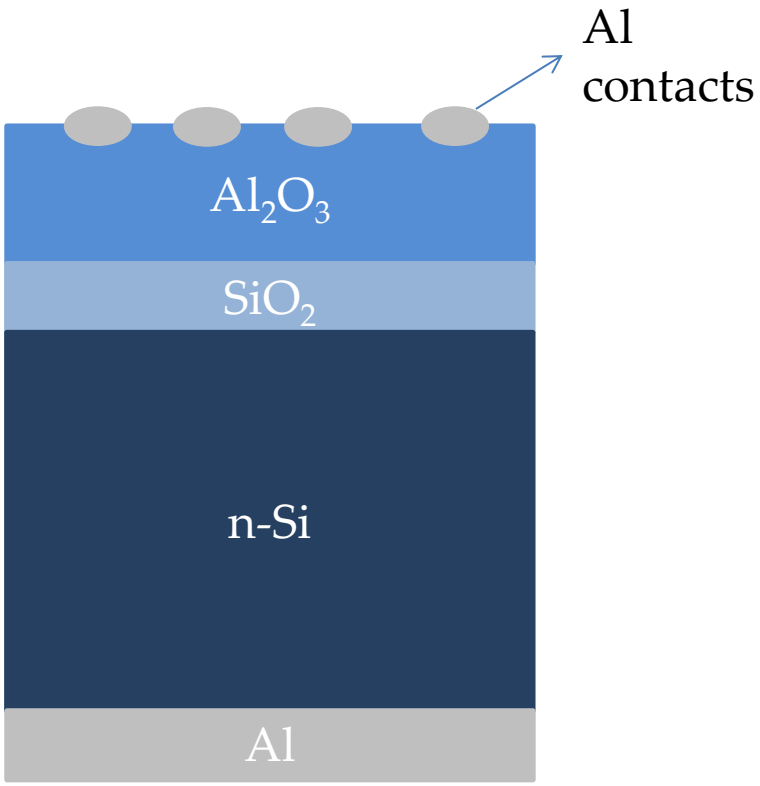
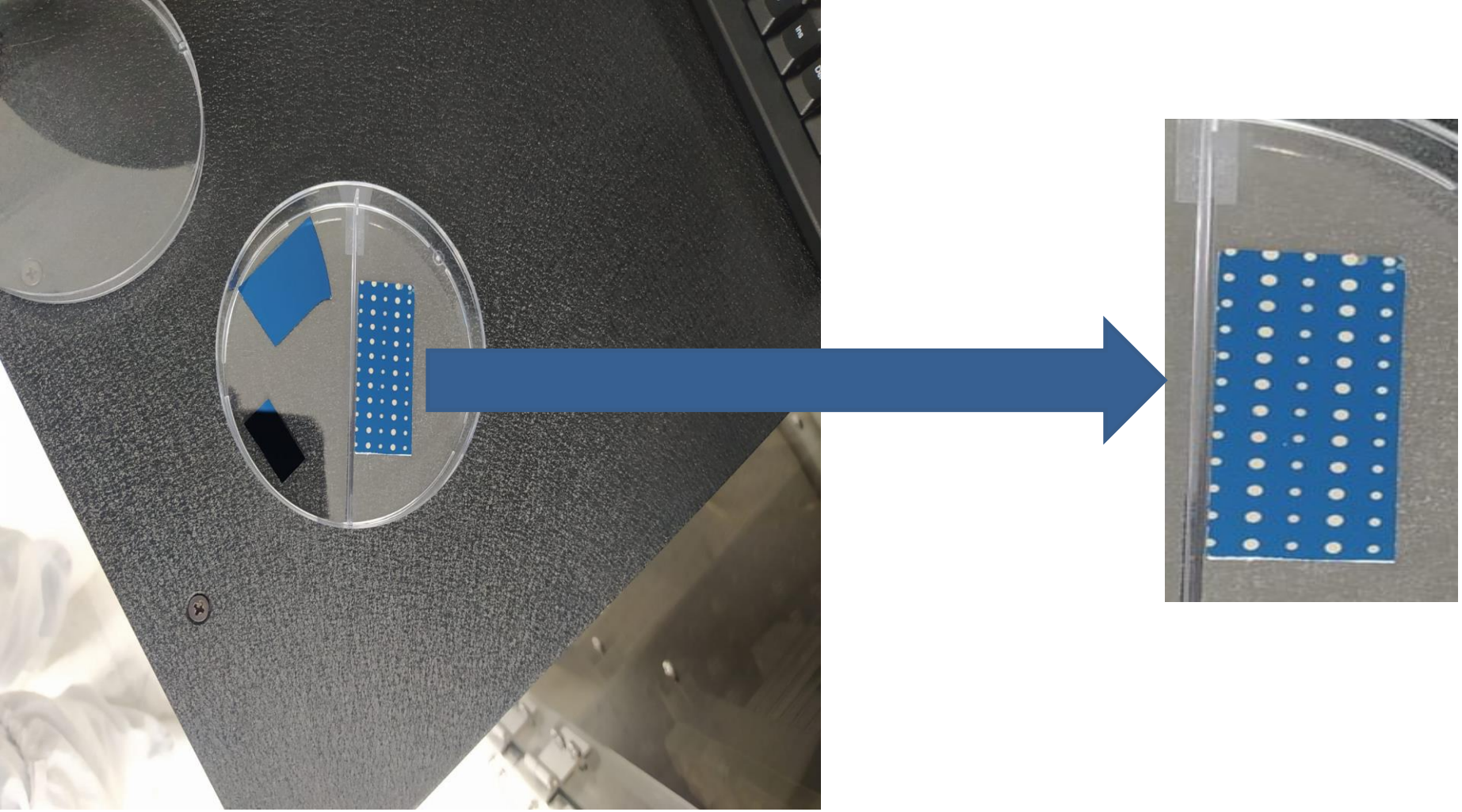
C-V and G/w - measurements



Cross-section of Al/Al_2O3/SiO_2/n-Si MOS capacitor

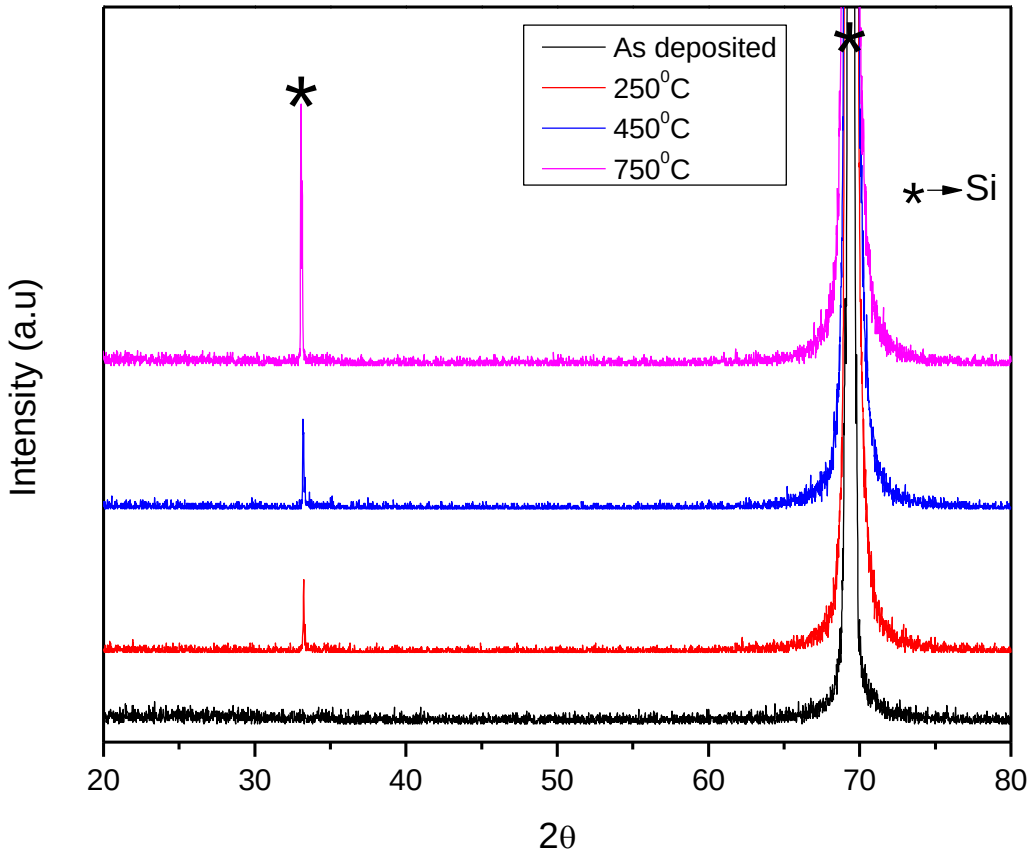
Schematic view of the fabricated Stacked



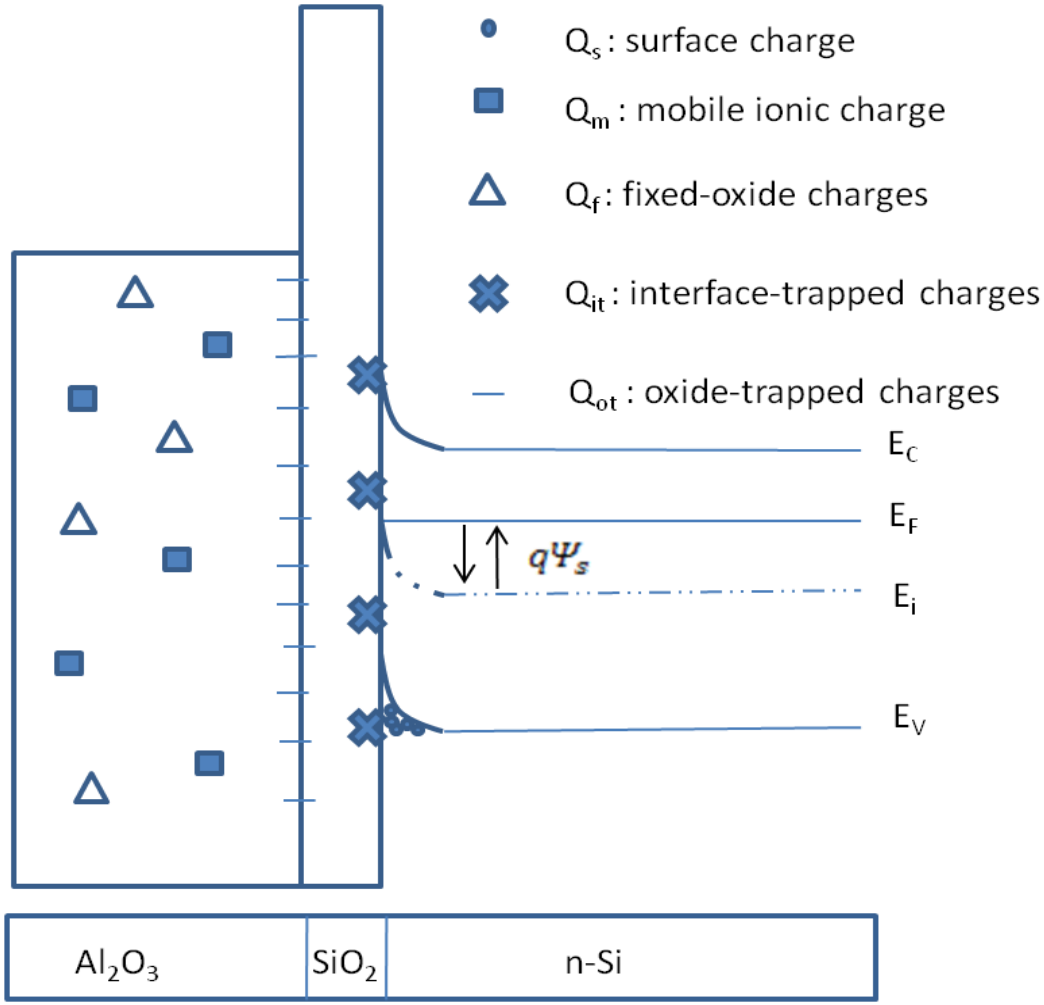
The fabricated $Al/Al_2O_3/SiO_2/n\text{-}Si$ MOS capacitor

The sputter machine from which the Aluminum contacts were deposited

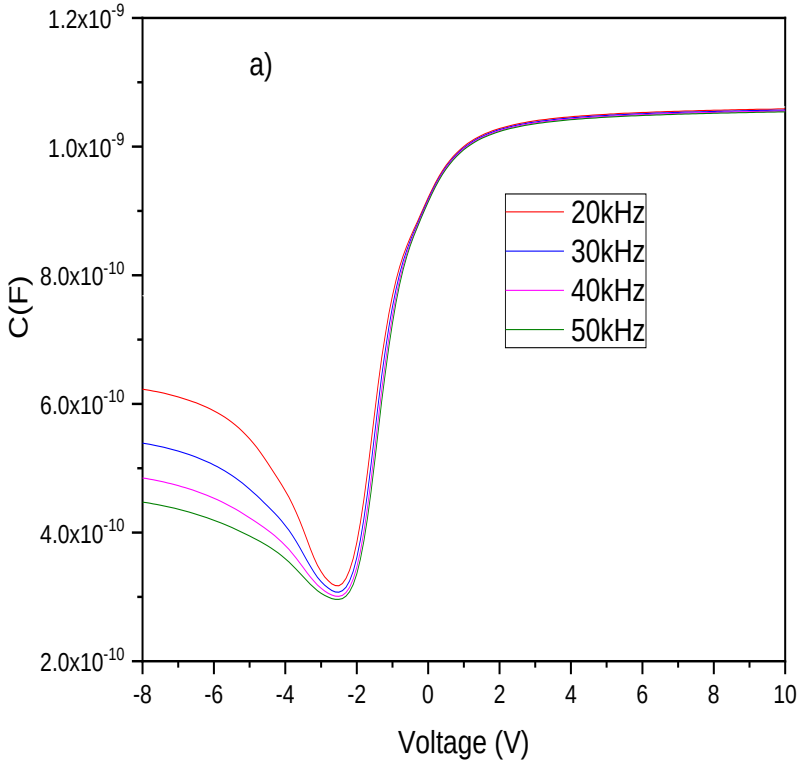
RESULTS AND DISCUSSIONS

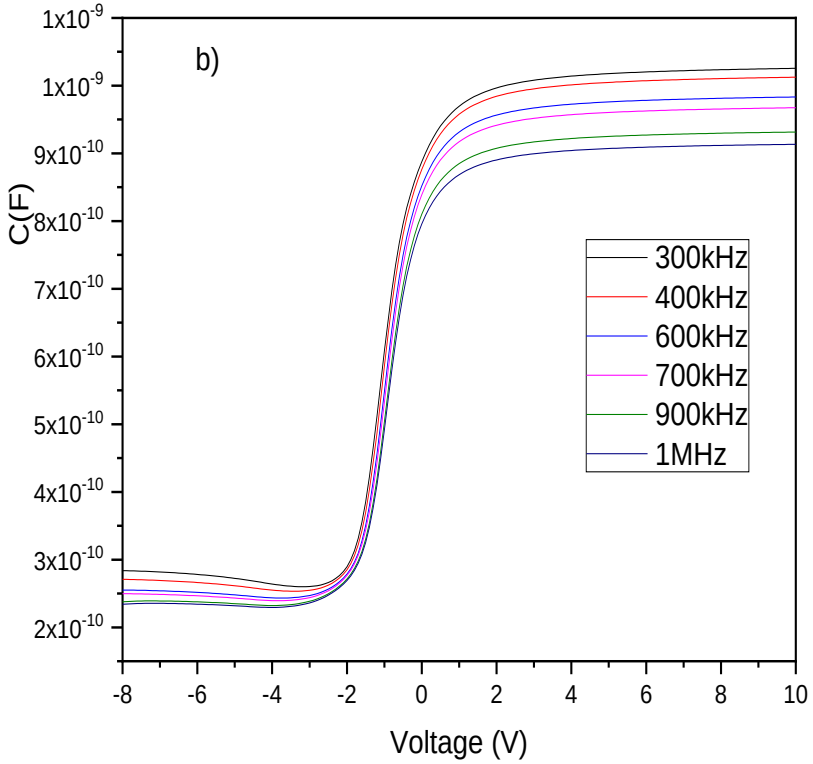


XRD patterns of the Al2O3/SiO2/Si structure as deposited and annealed at 250^{0}C, 450^{0}C, and 750^{0}C.

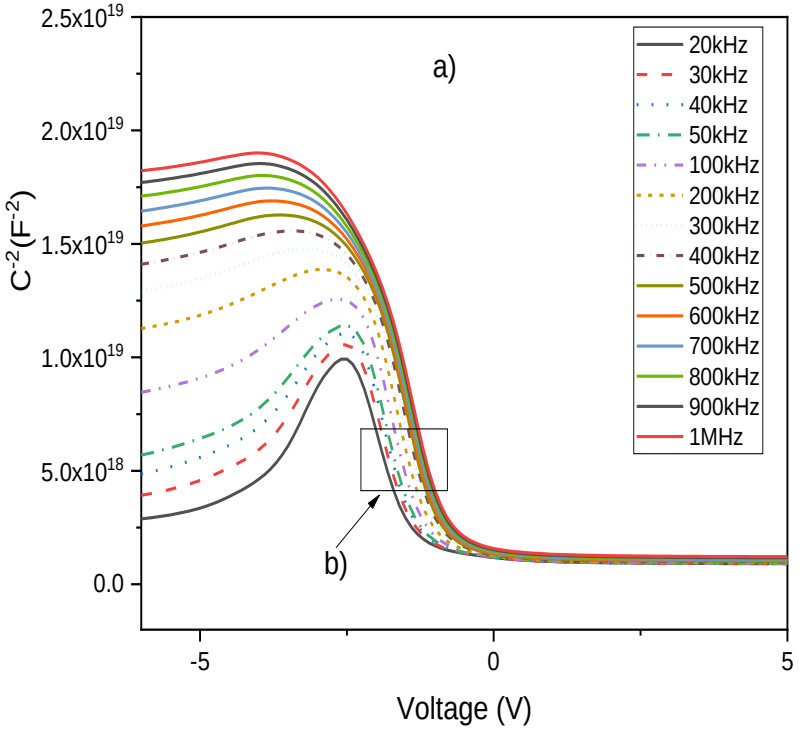


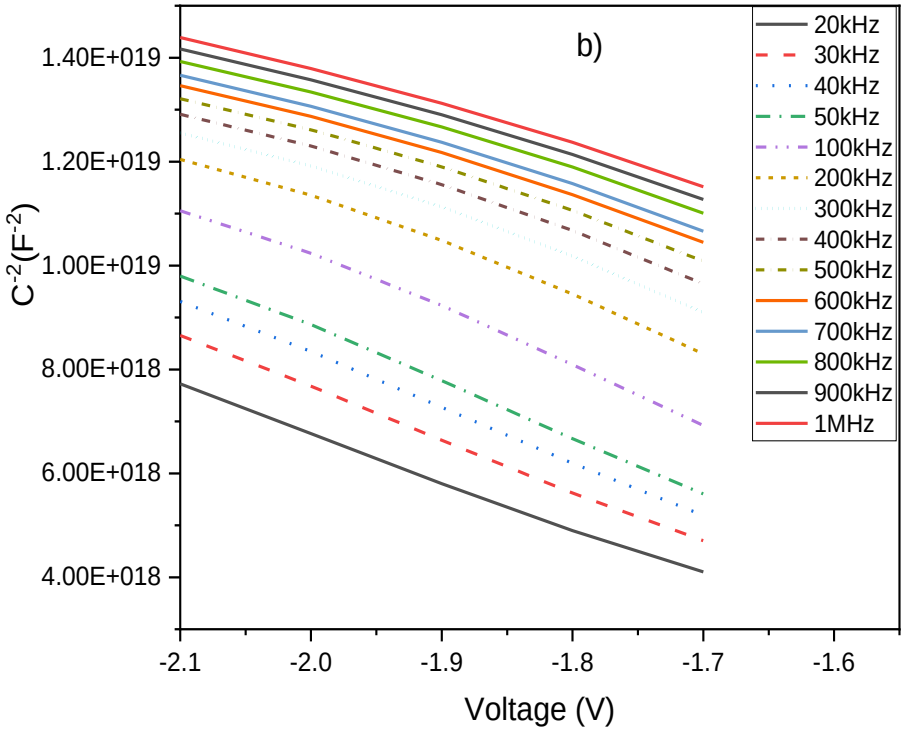
Distribution of charges in the Al_2O_3/SiO_2/n-Si multilayer [2].





a) Low frequency and **b)** High frequency corrected C-V curves for the $Al_2O_3/SiO_2/Si$ MOS capacitor annealed at 450^0C.





a) C^{-2}-V curves for the $Al_2O_3/SiO_2/Si$ MOS capacitor annealed at 450^0C. **b)** Linear region of the C^{-2}-V curves for the $Al_2O_3/SiO_2/Si$ MOS capacitor annealed at 450^0C.

Frequency (kHz)	V_O (V)	V_D (V)	N_D (x10^{15} cm^{-3})	E_F (eV)	$\Delta\Phi_B$ (meV)	Φ_B (eV)
20	-1.26	-1.23	4.16	0.228	21.945	1.02
30	-1.23	-1.21	3.80	0.231	21.356	0.996
40	-1.20	-1.18	3.65	0.232	21.004	0.965
50	-1.17	-1.14	3.58	0.232	20.759	0.931
100	-1.02	-0.999	3.64	0.232	20.172	0.787
200	-0.80	-0.774	4.03	0.229	19.457	0.564
300	-0.63	-0.603	4.39	0.227	18.708	0.394
400	-0.50	-0.474	4.64	0.226	17.918	0.266
500	-0.33	-0.366	4.85	0.225	17.044	0.158
600	-0.37	-0.347	5.03	0.224	16.983	0.140
700	-0.26	-0.237	5.05	0.223	15.581	0.0288
800	-0.18	-0.150	5.19	0.223	14.201	0.0582
900	-0.13	-0.101	5.24	0.222	13.115	0.108
1000	-0.08	-0.0534	5.29	0.222	11.681	0.157

Electrical parameters for the $Al/Al_2O_3/SiO_2/n\text{-}Si$ MOS capacitor annealed at 450^0C

CONCLUSION

Heretofore, radiation sensing capabilities of the $Al/Al_2O_3/Si$ and $Al/SiO_2/Si$ were studied [3,4], and for now, after analyzing the structural and electrical characteristics of the $Al/Al_2O_3/SiO_2/Si$ capacitor, it can be regarded as a prospective radiation sensing capacitor.

References

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Thank You