Conductivity nanocomposite SiO_xN_y and $SiO_xN_yAl_z$ films

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1. *Motivation*

- Silicon nanoelectronics.
- Investigation of the structure and electrical conductivity of SiO_xN_y and $SiO_xN_yAl_z$ films.

2. Experimment

- SiO_xN_y and $SiO_xN_yAl_z$ films up to 50 nm thick were obtained ion-plasma sputtering method with subsequent high-temperature annealing.
- Technological parameters: initial substrate p-Si. Gas flow parameters: Ar flow rate 50 ml/min, N_2-18 ml/min, O_2-18 ml/min, T=40-120°C, t = 7 min.
- Annealing in nitrogen and argon at T=1100°C for 1 hour.
- Methods of research:
  - -Spectral Elipsometry.
  - -IR Spectrometry,
  - - I-V characteristics.

3. *Results.*

- **The introduction of metal impurities Al into SiOxNy films leads to an increase in conductivity changing the conductivity mechanism, especially in the region of small fields (<1-2 V) (Fig.3).**
- **The effect of the annealing medium (nitrogen or argon) on the conductivity of SiOxNy and $SiOxNyAl_z$ films differs and depends on the applied voltage (field) and the measurement temperature. Annealing in nitrogen decreases low-temperature conductivity (Fig.1,2) in comparison with annealing in argon.**
- **The annealing significantly influences on conductivity in region of high voltages. The conductivity of SiOxNy film (Fig.4,5) and $SiOxNyAl_z$ (Fig.6) film are quite different.**

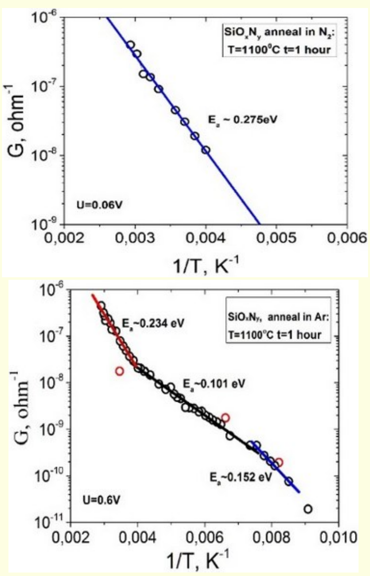

Fig.1. Influence of the annealing medium on the conductivity of the SiO_xN_y film: a) annealing in N2 (up); b) annealing in Ar (down).

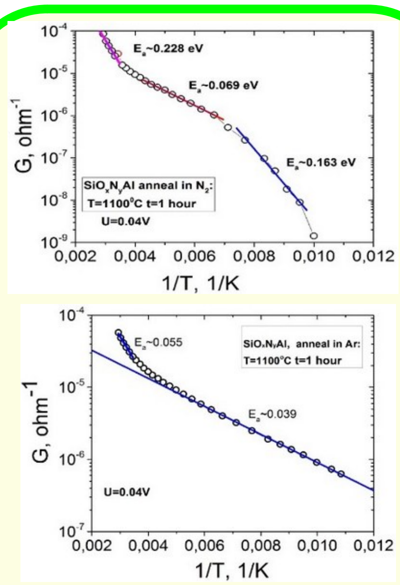

Fig.2. Influence of the annealing medium on the conductivity of the $SiO_xN_yAl_z$ film: a) annealing in N2(up); b) annealing in Ar (down).

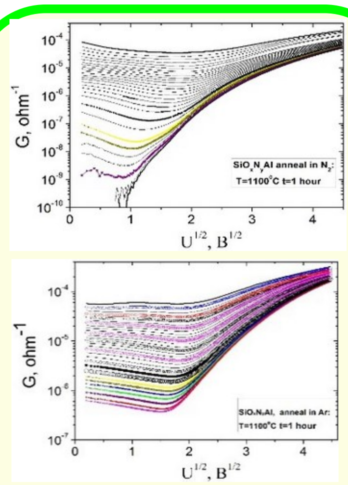

Fig.3. The conductivity of the SiO_x film vs $U^{1/2}$: a) annealing in N_2 (up); b) annealing in Ar (down).

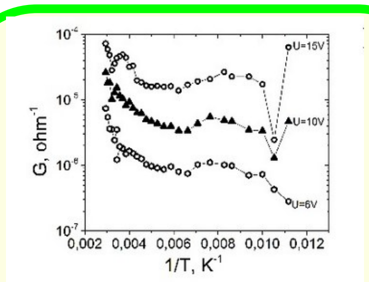

Fig.4. The conductivity of the SiO_xN_y film vs 1/T: a) annealing in N_2(up); b) annealing in Ar (down).

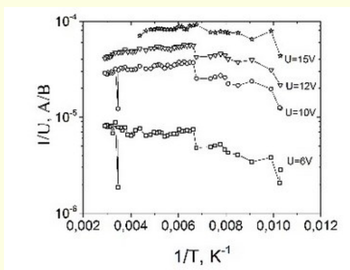

Fig.5. The conductivity of the SiO_xN_y film vs 1/T: a) annealing in N_2(up); b) annealing in Ar (down).

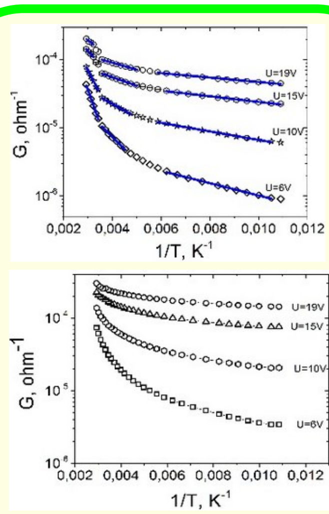

Fig.6. The conductivity of the $SiO_xN_yAl_z$ film vs 1/T: a) annealing in N_2(up); b) annealing in Ar (down).