

Frequency and radiation pattern reconfigurable antennas and metasurfaces based on Phase Change Materials (PCM) integration

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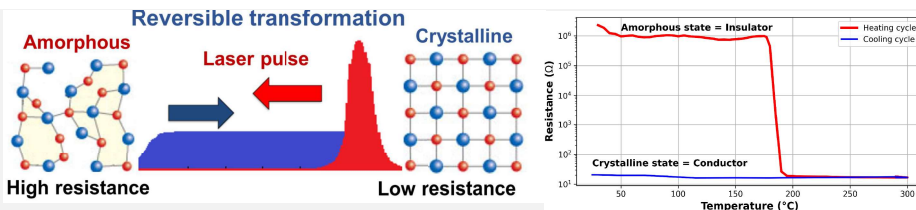
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Abstract: Phase Change Materials (PCM) have become a new paradigm to provide reconfiguration capabilities for the new generation of radiofrequency (RF) systems. This work focus on the characterisation of their electromagnetic (EM) properties in the microwave and millimeter-wave bands and their integration into reconfigurable RF devices (filters, antennas...)

Context and objectives

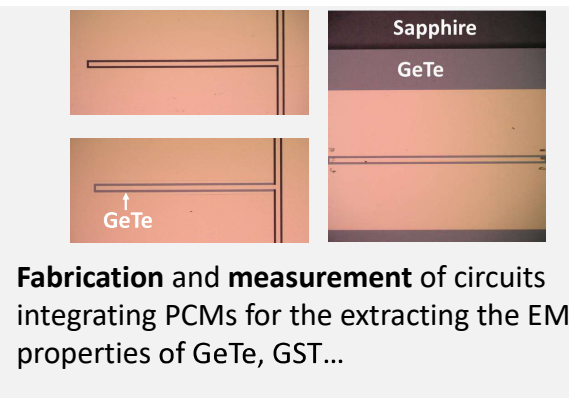


- PCMs can change from a **conductive state** (crystalline) to an **insulating state** (amorphous). The process is **bi-stable**.
- Suitable for the creation of complex reconfigurable RF devices such as filters, switches, **antennas**, etc.

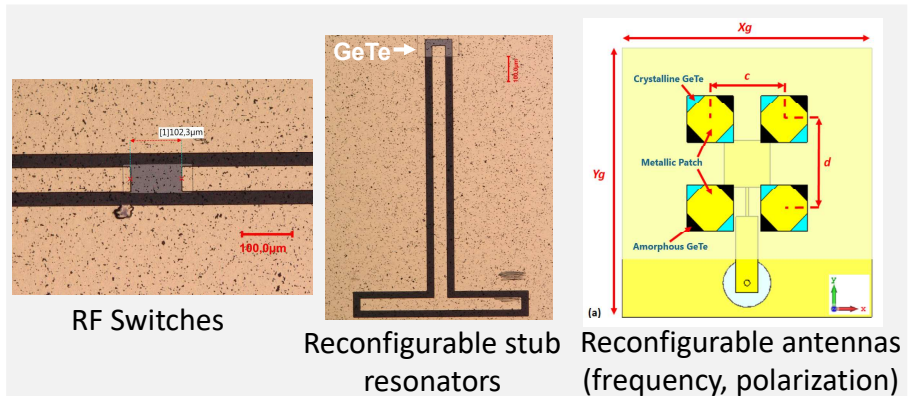
Challenges:

- No available **data** on the **electromagnetic properties** of PCMs in the **microwave/ mmW bands**.
- **Challenging to activate** from a crystalline state to an amorphous state.
- **Integration of PCM** into antenna systems for spatial applications.

Methodology



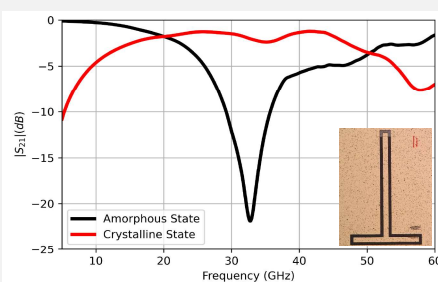
Integration of PCMs into reconfigurable systems



Results

Some compositions of PCM have been characterized in the MW/ mmW band:

- Germanium Telluride (**GeTe**)
 - $\epsilon_{\text{GeTe}} \approx 21$
 - $\sigma \approx 2 \times 10^{-2}$ in amorphous state
 - $\sigma \approx 2,3 \times 10^5$ in crystalline state
- Germanium Antimonium Telluride (**GST**):
 - $\epsilon_{\text{GST}} \approx 32$



Reconfiguration of a stub resonator demonstrated

Perspectives:

- Reversible transformation of PCMs using laser irradiation (large area, vectorial scanner)
- Design of a reconfigurable antenna array using PCM.
- Reconfigurable metasurfaces