Preliminary study of reservoir computing device using Ag-Ag_2S core-shell nanoparticles

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Neuromorphic devices are expected to have a high-performance arithmetic circuit with very low power consumption to be applied in many fields, such as a brain-like computer. In the present study, we demonstrated a preliminary study of reservoir computing (RC) hardware using the Ag-Ag_2S core-shell nanoparticles aggregation. The Ag-Ag_2S core-shell nanoparticles were synthesized by modified Brust-Schiffrin procedure at room temperature with Ag/S molar ratios of 0.25/1 as described in [1, 2]. The RC device was then fabricated by drop-casting highly concentrated nanoparticles in ethanol on to 50 ℃of multi electrodes device and characterized echo state properties, which exhibit phase shifting of output signal owing to the short-term memory effect as depicted in **Figure 1**. Another important key point of RC is that the device maps input signals into higher dimensional computational spaces through the dynamics of a fixed, non-linear system that indicated by the generation of higher harmonics at the output as shown in **Figure 2**. Our study on RC devices utilizing such nanoparticles suggested a great potential for further pattern generation as well as pattern classification tasks. The details will be presented at the conference.

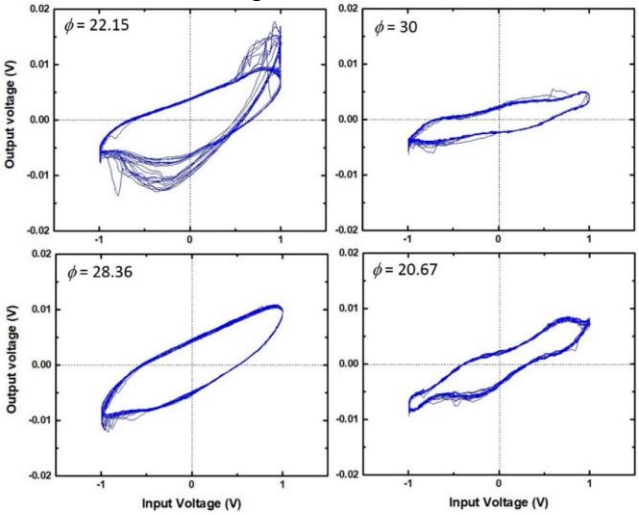

Figure 1. Lissajous curve obtained from each output electrodes exhibit phase-shifting with various magnitude of phase, indicating echo state properties.

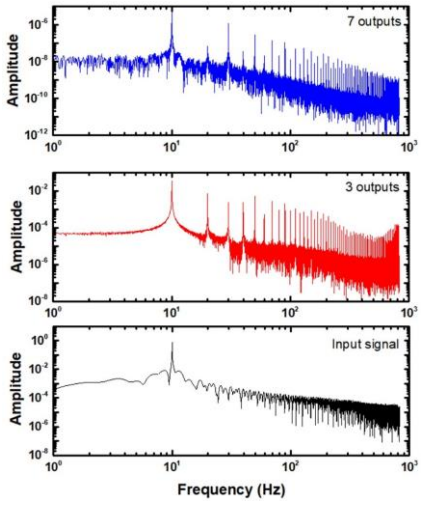

Figure 2. FFT of input and output. The output signal exhibit high harmonic generation indicating rich high dimensionality.

Keywords: *Atomic switches, Reservoir Computing, Ag-Ag_2S core-shell nanoparticles*

References:

[1] C. Battocchio et al., J. Phys. Chem. C 116, 19571 (2012)
[2] Hadiyawarman et al., Jpn. J. Appl. Phys. 59, 015001 (2020)