



## **A new COLLOIDAL cybernetic system tOWaRds 2030**

### **— LETS' FIND OUT MORE ABOUT COGITOR LAST ACHIEVEMENTS!**

COgiTOR project reached M24, and several notable technical progresses were reached by the joint collaboration of technical partners, IIT, Empa, Plasmachem, UWE:

- 1 A measurement system to assess the capability of commercial colloids to respond as expected in terms of Radio Frequency (RF) to DC stimulation was developed: it allowed us collecting around 10 GB of raw measurements of different colloidal suspensions. These measurements led to the assessment of the capabilities of the materials to memorize information and computing. Based on the

first results, we have started developing a dedicated integrated circuit for measuring the colloids state changes and implement, in an aggressive miniaturized and simplified fashion, the techniques used in the set-up but with very few hardware components to favour integration in a final set-up.

- 2** The chip is currently under design stages, and it will implement RF/analog and mixed-signal techniques and circuit solutions to achieve the read-out of the material state, thus providing a tool for understanding the behaviour of the colloids.
- 3** We obtained fundamental preliminary results on implementation of reservoir computing in colloid systems, achieving very nice demonstration of in memory computing, of liquid analogue memory equivalent to 6 bits of liquid state artificial recurrent neural network. Such results represent a unique achievement in science.
- 4** Alternative energy supply in the soft cybernetic system were explored. We designed thermomagnetic and photothermal energy converter models by 3D printing and used those for the investigation of the heat transfer in ferrofluids.
- 5** Several magnetic and infrared absorbing nanomaterials on the base of ferro magnetic liquids with different susceptibility and pyromagnetic effects were developed and supplied to the beneficiaries. These technologies and materials will lay the basement for computing subsystems used in later tasks.

The development of self-healing soft skins for protecting the functional colloids has advanced improving the mechanical and

- 6 self-repairing properties as well as providing energy to the autonomous liquid robot.

In parallel the dissemination, communication and exploitation activities were carried out, reaching important milestones:

- A Systematic Stakeholder Analysis was carried out by **CTECH**. The identified stakeholders were invited to participate in an online survey, designed to measure their characteristics, e.g., their interest, attitude, influence, and knowledge relevant for the project.
- A patent was deposited by IIT on the 7th November 2022: "**Sistema e metodo per la memorizzazione di informazioni**", reference n° 102022000022839, date of deposit, inventors: A. Chiolerio and M. Crepaldi.
- **PLASMACHEM** has performed the synthesis of several types of nanoparticles including a new material that was characterized and will be included into the portfolio of the company and sold worldwide through the existing catalogue channel.



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