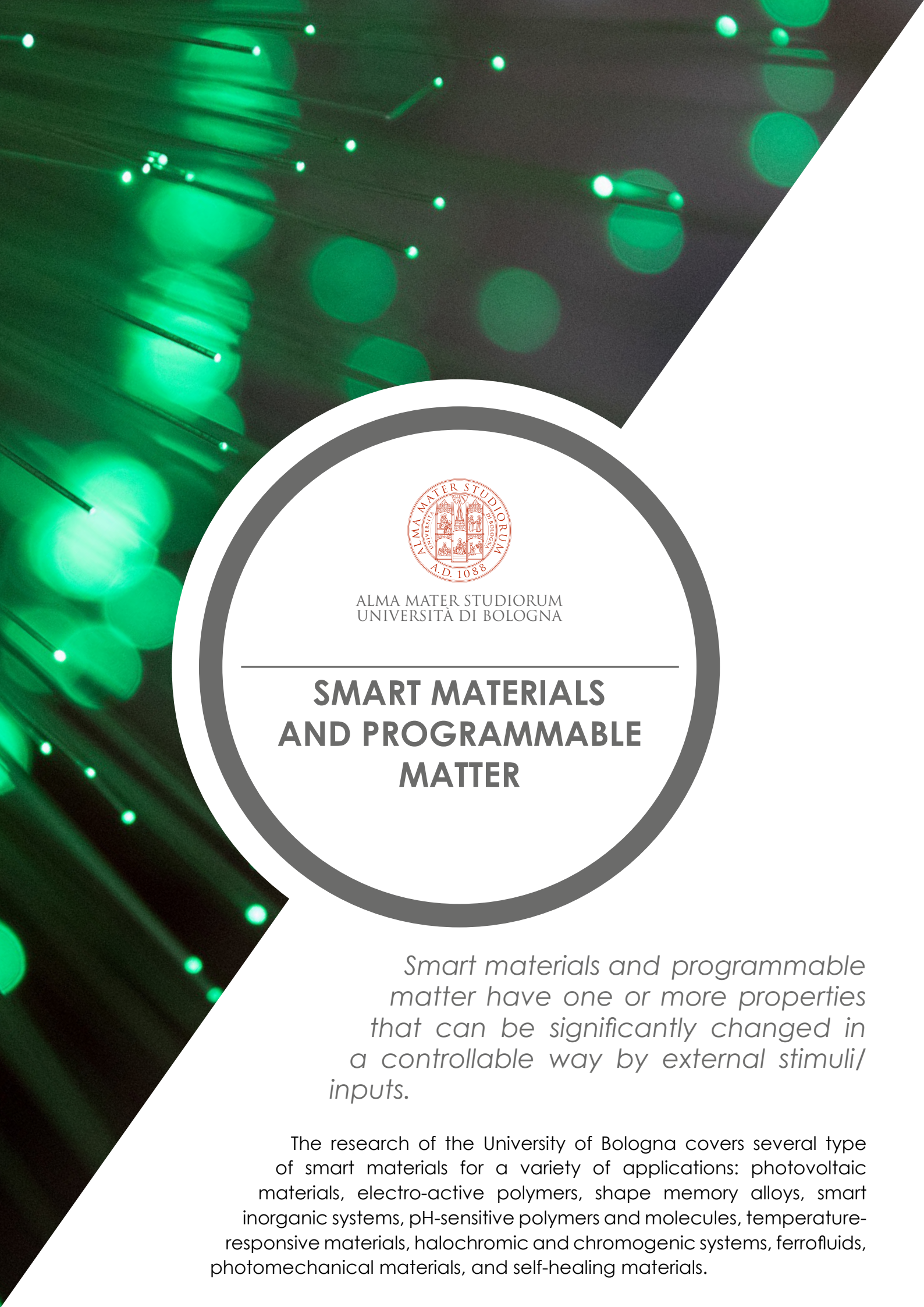

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

SMART MATERIALS AND PROGRAMMABLE MATTER

Smart materials and programmable matter have one or more properties that can be significantly changed in a controllable way by external stimuli/ inputs.

The research of the University of Bologna covers several type of smart materials for a variety of applications: photovoltaic materials, electro-active polymers, shape memory alloys, smart inorganic systems, pH-sensitive polymers and molecules, temperature-responsive materials, halochromic and chromogenic systems, ferrofluids, photomechanical materials, and self-healing materials.

The research of the University of Bologna covers a wide range of issues:

- Smart two-dimensional material-based time modulated array for RFID applications
- Development of adhesive durability materials for root canal using self-adhesive resin cements
- Smart barriers for Sustainable Food Packaging Applications
- Hybrid nanocomposites based on electroactive hydrogels and cellulose nanocrystals for high-sensitivity electro-mechanical underwater actuation
- Anti-listerial coatings entrapping living bacteria

HIGHLIGHTS

On a daily basis, the researchers of the University of Bologna design, produce and characterize materials that qualitatively and quantitatively respond to stress, temperature, moisture, pH, electric or magnetic fields, light, or chemical compounds. Applications include sensors and actuators, shape memory materials, Nature-inspired systems, and artificial barriers to chemicals or physical agents. Techniques in use include AFM, SEM, DLS, X-ray, time-resolved spectroscopies, FTIR, confocal microscopy, and SECM.

The University of Bologna actively contributes to research and innovation on smart materials also through several projects funded under the European Union's Framework Programmes **Horizon 2020** and **FP7**:

- **SiNBioSys** - *Luminescent silicon nanocrystals as bioimaging systems* (Horizon2020 – ERC): to develop a highly-robust and biocompatible hybrid material, which exhibits colour tunability across the visible and near-infrared region, and an extraordinary brightness of the material coupled to a long-lived luminescence which enables time-gated detection
- **LEAPS** - *Light effected autonomous molecular pumps: Towards active transporters and actuating materials* (Horizon2020 – ERC): to develop the first synthetic photochemical supramolecular pumps and to apply them for performing nanoscale transport functions and macroscopic actuation
- **HYSENS** - *Hybrid Molecule/Nanocrystal Assemblies for Photonic and Electronic Sensing Applications* (FP7-NMP): to harness the complementary properties of organic functional materials and inorganic nanocrystals to fabricate novel hybrid materials
- **i-FLEXIS** - *Integrated flexible photonic sensor system for a large spectrum of applications*: from health to security i-FLEXIS . FP7-ICT): to develop an innovative, reliable and low-cost integrated X-ray sensor system based on heterogeneous inorganic, organic and hybrid components