

# SOFT MECHATRONICS (SMARt): ELECTROSTATICALLY DRIVEN ELASTOMERS

## OBJECTIVES

The purpose of the SMARt project is to characterize Electro Active Polymers (EAP) and to explore, from a fundamental point of view, several new types of applications.

## APPLICATIONS

Dielectric EAP (DEAP), also called Dry EAP, are generally limited by the high voltage required for their actuation and a relatively low force produced. However they have higher strain rate than bulk piezoelectric elements. Their Mechanical Energy per Mass is higher than Amplified Piezo Actuators APA®. Therefore the EAPs have a lot of potential in applications where large strokes are required.

## FRAMEWORK

Within the framework of the SMARt project, CEDRAT TECHNOLOGIES (CTEC) has been involved in several key tasks:

- Assistance to partners in the development of active materials (TRL 1-2),
- Design of test-benches for electromechanical characterization of EAP,
- Electromechanical tests performed on EAPs using dedicated instruments and facilities in various environmental conditions of temperature and humidity,
- Analyses of the performances of EAPs in order to improve the models for further development of active devices (TRL 3-4),
- Trade-off analyses between EAPs and CTEC standard actuations with similar strokes (extract below in Table 1),
- Identification of key advantages and implementation in structures in view of future fields of applications,
- Development of electronics. For instance to supply sufficient voltage to the EAPs (up to 3kV see Figure 2). Special care is taken for the electrical safety.

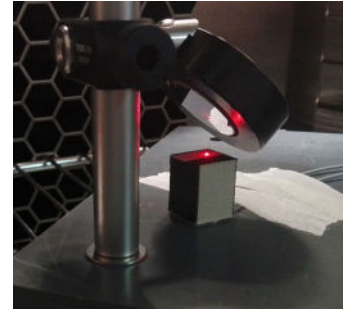


Fig. 1: Stroke determination of EAP ref SXT1A-1520 from SATECO XT AG



Fig. 2: Focus on EAP : SXT1A-1520



Fig. 3: APA600M

PARAMETER	EAP: SXT1A-1520	APA600M
Stroke (µm)	650	550
Blocked force (N)	10 <sup>(1)</sup>	24
Height (mm)	20	14.6
Equivalent strain (-)	3.25%	3.8%
Mechanical Energy (mJ)	3.25	6.6
Weight (g)	5.5	14.2
Mechanical Energy per Mass (mJ/g)	0.59	0.46
Electrical static capacitance (nF)	121	3200
Voltage (V)	[0, 1200]	[-20, 150]
Electrical Energy (mJ)	87.1	46.2
Electromechanical Coupling (-)	3.7%	14.3%

(1) Manufacturer data - not measured

Table 1: Performances of APA600M and EAP ref SXT1A-1520 from SATECO XT AG



Fig. 4: Electronic for EAP driving (max 3kV)

## PARTNERS

The SMArT consortium is made of 4 partners located in France:

- [CNRS](#)
- [ESPCI](#)
- [ENSTA ParisTech](#)
- [CEDRAT TECHNOLOGIES](#)

In addition, CEDRAT TECHNOLOGIES has also collaborated with [SATECO](#)

