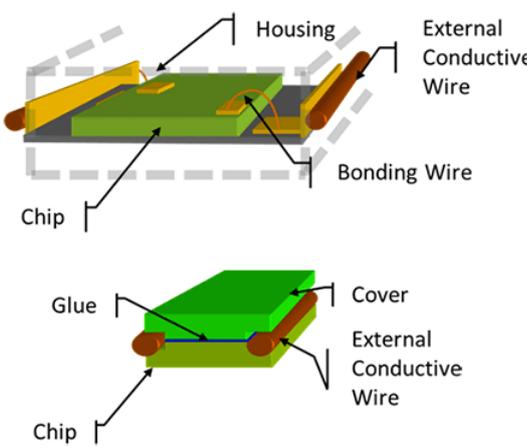# High-priority product: <u>Micro-parts for wearable devices</u>

Designation of multi-material multi-functional product:	*Please entitle your product* Textile thread with embedded electronic component (LED, RFID or SENSOR chip) for technical textile applications
General description of product (3 – 4 sentences):	*Please explain purpose, application and advantage of your product* By combining extreme miniaturization and flexibility, new electronic technologies have enabled the recent development of smart textiles. Applications of smart textiles can be found in sport & leisure, health & medical, transport & space, clothing, interiors, etc. Electronic thread technology enables invisible, inalterable and inseparable electronic functions like light, monitoring or traceability inside textiles or plastics.
Multi-materials needed/required:	*Please indicate, which different materials are foreseen* Electronic thread technology combines textile fibers with electronic components and conductive wires. Embedded components can be either packaged devices (LED with specifically developed glass cover) or bare silicon dies. The electronic thread packaging and assembly combines those dies or chips with external conductive wires. Further processing condition this assembly under the form of a textile thread that can be coated. Materials used in this product range from silicon dies, polymer glues, textile filament, polymer coating.
Multi-functionality needed/required:	*Please explain the multi-functional approach of your product* The electronic thread enables the integration of electronic functions in textiles. The electronic functions of the embedded components are combined with the mechanical properties of the textile fibers.
Expected improvement:	*Please indicate and explain the improvements you expect* The miniaturization of the electronic components will provide a flawless embedding of the electronics in the smart textiles. Functional threads with no detectable local thickness excess will then be fully compatible with weaving, knitting, sewing processes, opening the way to a much broader set of application and application areas.
Bottlenecks to overcome for reaching the expected improvement	*Please indicate, which bottlenecks do you have to overcome for realizing your product?* The current bottlenecks are : 1) Miniaturization of the electronic function: the size of usable chips or stacks of chips for being included in a yarn should stay below a cube of roughly 0.5 to 1mm of side. This is currently achieved by LEDs and RFID, some work remains to be done for sensors, with a reasonable economic cost. Communication channels must be as well restricted to a few conductive wires. 2) Robustness and ability to sustain various textile and plastic manufacturing processes. Sustaining the accelerations, tensions, mechanical stress of textile

	weaving or knitting, and chemical and thermal stresses of textile post-processing is mandatory. 3) Automation: Some of these process steps are not yet fully automated, restricting the production of large quantities at an economically viable cost. Breakthroughs in the processing and assembly of multi-material micro-parts are required: handling, dicing, clamping, soldering, embedding, etc.
Functional requirements:	*Please indicate functional requirements of your product (e.g. geometrical requirement, minimum feature sizes, aspect ratios, surface roughness, material requirements, process requirements, characterization requirements)* Size of the electronic components is a critical requirement for their integration in electronic thread. For a flawless integration, components size should not exceed 500 to 1000 µm per side. For the most restrictive applications, conductive wires must present a very good conductivity for a maximum diameter of roughly 100 µm. In terms of materials, their compatibility with textile manufacturing processes, as well as cleaning processes, must be guaranteed.
Technical sketch of product (if applicable):	*Please insert a sketch indicating geometrical dimensions of your product* Prior Art (top) versus electronic thread (bottom) – NOT TO SCALE (bottom is 10x smaller)