

| <u>Name</u>    | <u>Organisation</u> | <u>Project title</u>  | <u>Decision No.</u> | <u>Decision date</u> | <u>Funding period</u>   | <u>Funding</u> |
|----------------|---------------------|---|---------------------|----------------------|-------------------------|----------------|
| Jantunen, Heli | OY                  | Ceramics with ultra-low processing temperature for printed electronics (ULTRA-CERAMICS) | 130639              | 05.02.2009           | 01.08.2009 - 31.12.2010 | 124 580        |

**Project description**

Objectives and short description of the project: Funding for Senior Scientist is applied to enable one full-time research year to start research according to the set plan and for supervising research in Finland or abroad. The plan relates and supports the applicant's personal four years research plan. This plan is for the next four years and financing after the Senior Scientist period will be applied elsewhere. Senior Scientist position would enable wide survey of the most fruitful methods to succeed in the presented research area, ceramics with ultra low processing temperature for printed electronics. Additionally the Senior Scientist period would offer an opportunity to the applicant to concentrate on scientific research after being five years a full professor. In this manner the proposed research could be started in some extent and especially international cooperation network could be strengthened. The main goal of this research is to make ultimate leap enabling processing of wide variety of ceramic materials at ultra low temperatures denoted as Ultra-Ceramics (200-500 oC). The project has high risks, but advantages like utilization of pure ceramic materials on challenging substrates like plastic and paper could offer novel scientific results as well as business opportunities to European industry. Key issues based on scientific laws of matters to succeed are - intelligent selection and development of starting materials - utilization of nano technology - management of dense and uniform packaging of powder particles - management of type, level and rate of diffusion in sintering - microwave sintering - combined understanding of materials, their processing and application demands forming the basic research methodology. There are several reasons why this kind of Ultra-Ceramics has not been deeply and thoroughly researched. One main issue is that high conductive electrodes made of silver or copper could not be earlier fabricated at low temperatures. However, nano particle silver pastes sinterable at ~ 200 oC have recently become commercially available. Additionally only recently ceramics with nano particle size have been widely on the market and thus industry has not had profitable way to utilize this option. Finally, real attempts to decrease the sintering temperature of ceramic material below 500 oC and even to 200 oC have not been reported. However, taking the high risk, ground-breaking challenge, ultimate novel materials and processes to enable business opportunities are available. It is also obvious that novel scientific results will be created especially where combination of several techniques like e.g. microwave sintering, nano particles, sintering aids, activation energy or nano particle silver electrodes, nano ceramic, multi-cross printing are researched.