Jožef Stefan Institute
Center for Technology Transfer and Innovation

TECHNOLOGY OFFER

SCIENTIFIC INSTRUMENT FOR STUDYING TRANSIENT CURRENTS IN SEMICONDUCTORS

Fields of use
Semiconductors, Apparatus Engineering, Micro- and Nanotechnology, Analyses/Test Facilities and Methods, Other analytical and scientific instrumentation, Other Industrial Products (not elsewhere classified)

Current state of technology
Already on the market

Type of cooperation
Commercial agreement with technical assistance, Technical cooperation agreement

Intellectual property
Copyright, Exclusive Rights, Secret Know-how

Developed by
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More information about the invention

Summary

A spin-out company of a leading Slovenian scientific research institute has developed a highly specialized instrument for applying transient current technique in research of semiconductors. The company is looking for companies specialized in development and marketing of scientific instruments to jointly develop a new version of mass-produced instrument for educational purposes. The company seeks technical agreements, and distributors for cooperation agreements with technical assistance.

Description of the invention

One of the major challenges in the field of semiconductor detectors is the adjustment of semiconductor detectors to operate in high radiation fields (particle physics, nuclear, beam therapies) and medical applications. Transient current technique is one of the most versatile techniques allowing the studies of fundamental semiconductor material properties on one side and complex device performance on the other. It is used in characterization of a wide range of particle detectors, material research and electronics industry.

The technique exploits generation of non-equilibrium carriers in semiconductor by short pulses of laser light (or particle) and follows the response of the device as the carriers drift/diffuse/recombine.

A spin-out team at the Slovenian research institute has developed two different systems, a Compact/Educational Transient Current Technique (TCT) System and a more elaborate and larger system, called Scanning-TCT.

The compact Compact/Educational TCT System is a portable/table system intended for use at educational institutions (basics of semiconductors) and at research institutions for state-of-the-art studies of semiconductor material properties. It is used in elementary particle physics and all other applications where semiconductor changes after exposure to different types of radiation are explored, such as dosimetry, photovoltaic, nuclear medicine and radiology.

On the other hand, the more elaborate and larger system, called Scanning-TCT, uses focusing optics (beam spot of few microns) and a full 3D translation stages to move the laser beam with sub-micron precision across the device for studies of position resolved response.

Both systems encompass fast pulsed laser (full width at half maximum, FWHM ~350ps) of different wavelengths, full readout electronics chain (HV filters, Bias-T, wideband amplifiers), temperature controlled mounting plane (Peltier element), data acquisition and control software and a software package for signal analysis. The Scanning-TCT includes in addition the computer-controlled stages and complex focusing optics. There

are several add-ons to the system such as multi-electrode readout, beam monitors, beam locators etc. Due to the good results obtained with this system, ease of use and because of the long experience and reputation of the research group in this area, many research institutions have already acquired TCT instruments from the Slovenian company.

In collaboration with leading scientific institutions the company team has detected a market niche of available scientific instruments applying TCT technique in educational purposes. Though the team has developed the prototype of Compact/Educational TCT System, in the next stage they would like to find a partner for joint development of a commercial TCT instrument for educational purposes which could be mass produced and sold internationally.

The Slovenian company is looking for partners specialized in scientific instrument development with established access to market to jointly develop a new version of commercially available instrument for educational purposes. Also, distributors with access to market of educational instruments with extensive experience about demands in science and engineering education community are sought. The company is offering cooperation under technical agreement and commercial agreements with technical assistance.

Main Advantages

Different innovative measurement procedures are supported in the analysis package of the instrument: such as Edge-TCT (Transient Current Technique device edge illumination), Top-TCT or Single Event Upsets configuration. The main advantages over custom made systems are:

- Ease of use.
- Standardized mounts.
- User support.
- High quality results of the TCT measurements.
- Cost effective and cheaper than currently available solutions.

The system contains the following innovative solutions for basic requirements for good TCT measurements:

- Fast laser pulses (FWHM~350 ps).
- High bandwidth amplifiers (>3 GHz).
- Bias-T enabling high voltage (2 kV) connection to Device Under Test (DUT).
- Focused laser beam and precise positioning of DUT allowing studies of response of the device depending on the place of laser light impact. DUT is mounted on a <1 µm resolution x-y-z moving stages with range of 10 cm.
- Temperature control of DUT is provided by liquid cooled Peltier element.

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Partner Sought

Type of partner sought:

- Companies specialized in scientific instrument development and marketing.
- Distribution partners or specialist dealers of scientific instruments.
- Partners with access to market of educational instruments with extensive experience about demands in science and engineering education community.

Activity of Partner:
The partners sought develop, sell or distribute scientific instruments, preferably for educational purposes. Partners should be able to add know-how in joint development of specific features of the new instrument for educational purposes.

Specific role of partner sought:
The partner should be able to significantly contribute to a market research, customer value proposition and a technical specification of niche features of new instrument for the scientific and educational market; e.g. semiconductor materials study..