VAMAS

Raman Spectroscopy
Technical Work Area 42

Semiconductors
Technical Work Area 46

Call for Participation

Joint Project 42-8 and 46-3

Standardising Lattice Strain Measurements in Semiconductor Substrates using Raman Spectroscopy

Objectives

To develop and validate standardized methodologies for strain measurement in epitaxially grown silicon–germanium (SiGe) materials using confocal Raman spectroscopy.

Background

With continued device scaling and rising performance demands, accurate characterization of lattice strain is increasingly important for materials development and process control. Strain affects carrier mobility, band structure, and defect formation—key factors in semiconductor performance.

Raman spectroscopy offers a non-destructive, high-resolution method for strain analysis, but differences in instrumentation, calibration, and data interpretation can lead to inconsistent results. This initiative supports the harmonization of Raman-based strain measurements in epitaxial SiGe, enabling traceable and comparable data across laboratories worldwide

Standardization Needs

Currently, no international standard exists for quantifying strain in SiGe using Raman spectroscopy.

The H2020 "CHALLENGES“ project demonstrated the method’s precision and robustness across various Ge concentrations and instrument types. In response to a formal request from ISO/TC 201, PTB is coordinating this VAMAS interlaboratory comparison to support global standardization of strain and stress measurement in semiconductors.

Work Programme

Each participant will receive two representative samples consisting of epitaxially grown SiGe layers on silicon substrates. The two samples share an identical layout but differ in their germanium content, resulting in distinct strain levels. These strain states are verified using complementary techniques such as XRD, XPS, or XRF.

A measurement protocol, jointly reviewed and approved by national metrology institutes, will guide all procedures. It covers measurement conditions, sample handling, and data reporting to ensure consistency and comparability of results across laboratories, regardless of instrument type or manufacturer.

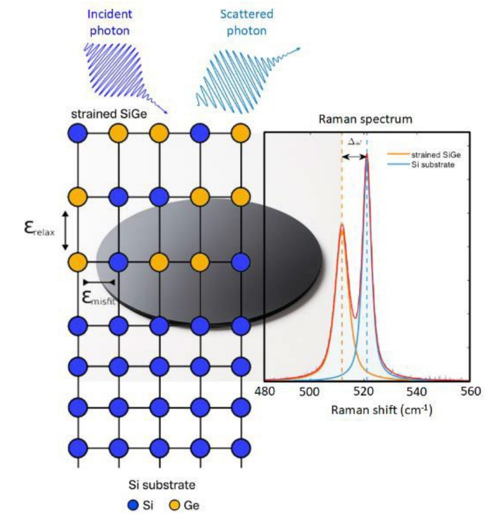

Figure: Illustration of phonon excitation in strained SiGe and Si substrates, along with Raman spectral measurements showing the difference in Raman responses between Si and SiGe.

Deliverables and Dissemination

The primary outcome of the study will be a validated measurement protocol for strain analysis in epitaxial SiGe using Raman spectroscopy. The findings will be summarized in a joint scientific publication and shared with the broader metrology and semiconductor communities.

Based on the results, a proposal for an international standard (ISO work item) will be initiated through ISO/TC 201 to support global harmonization of strain measurement procedures in semiconductor materials.

Funding

This study receives no external funding; all participants contribute on a voluntary basis, and the samples are provided free of charge for measurement purposes.

Status

Samples have been dispatched to registered laboratories. A draft measurement protocol has been developed and is currently under review by national metrology institutes. Measurements will begin once the protocol has been approved.

For more information:

Project Leaders:
Dr. Rainer Stosch , PTB/Germany
rainer.stosch@ptb.de

Stefan Wundrack, PTB/Germany
stefan.wundrack@ptb.de

TWA 42 Chair
Dr. Erlon Henrique Martins Ferreira
ehferreira@inmetro.gov.br

TWA 46 Chair
Dr. Fernando Castro
fernando.castro@npl.co.uk

www.vamas.org

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