Prof. Lionel C. Kimerling

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Education:

Ph. D. in Metallurgy, Massachusetts Institute of Technology, (1969)

B.S. in Metallurgy, Massachusetts Institute of Technology, (1965)

Research Interest:

Prof. Kimerling's research activities address the fundamental science of imperfection in solids and the processing of electronic materials. All his programs include an emphasis on both materials science and applications. His MIT research on silicon processing has addressed photovoltaic cells environmentally benign integrated circuit manufacturing. Among the achievements of this research are the creation of a process simulator for wafer contamination gettering; development of a new ultrasensitive measurement for silicon surface perfection; the discovery of a surface passivation method for the reduction of cleaning steps in manufacturing; and the development of in-situ diagnostic tools for wet chemical process control. His group's Microphotonics research has produced a series of first ever achievements with the goal of monolithic integration of optical interconnection with integrated microelectronic circuit chips. The research has developed submicron dimensioned optical structures by employing materials systems with high refractive index contrast for confining light. His research results in this area include the optoelectronic physics and materials processing of rare earth-doped semiconductors culminating in the first room temperature operational, erbium-doped silicon light emitting diode; the monolithic integration of MOSFET driver circuitry with Si:Er LEDs and Si/SiO2 waveguides; the process development silicon optical waveguides to yield low loss microphotonic signal distribution; the fabrication and demonstration of the first waveguide-integrated microcavity resonators based on photonic crystal designs at a wavelength of 1.54 microns; the fabrication and demonstration of optical add/drop microphotonic circuits for high capacity WDM data distribution based on microring resonator filter junctions; and the process development and testing of high performance, heteroepitaxial Ge-on-Si photodetectors for microphotonic applications.

Publications:

Patel NS, Monmeyran C, Agarwal A, Kimerling LC. Point defect states in Sb-doped germanium. *Journal of Applied Physics*. 2015;118(15):155702.

Han Z, Zhang L, Kimerling LC, Agarwal AM. Integrated Midinfrared Laser Based on an Er-Doped Chalcogenide Microresonator. *Ieee Journal of Selected Topics in Quantum Electronics*. 2015;21(1).

Broderick LZ, Albert BR, Pearson BS, Kimerling LC, Michel J. Design for energy: Modeling of spectrum, temperature and device structure dependences of solar cell energy production. *Solar Energy Materials and Solar Cells*. 2015;136:48 - 63.

Kimerling LC, Kwong D-L, Wada K. Scaling computation with silicon photonics. Mrs Bulletin. 2014;39(8):687 - 695.

Cai Y, Yu W, Kimerling LC, Michel J. Chemical Mechanical Polishing of Selective Epitaxial Grown Germanium on Silicon. *Ecs Journal of Solid State Science and Technology*. 2014;3(2):P5 - P9.

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Soref, R. (2010). Mid-infrared photonics in silicon and germanium. *Nature photonics*, 4(8), 495-497.

Gan, X., Shiue, R. J., Gao, Y., Meric, I., Heinz, T. F., Shepard, K., ... & Englund, D. (2013). Chip-integrated ultrafast graphene photodetector with high responsivity. *Nature Photonics*, 7(11), 883-887.

Feng, L., Ayache, M., Huang, J., Xu, Y. L., Lu, M. H., Chen, Y. F., ... & Scherer, A. (2011). Nonreciprocal light propagation in a silicon photonic circuit. *Science*, *333*(6043), 729-733.

Süess, M. J., Geiger, R., Minamisawa, R. A., Schiefler, G., Frigerio, J., Chrastina, D., ... & Sigg, H. (2013). Analysis of enhanced light emission from highly strained germanium microbridges. *Nature Photonics*, *7*(6), 466-472.

Liu, H., Wang, T., Jiang, Q., Hogg, R., Tutu, F., Pozzi, F., & Seeds, A. (2011). Long-wavelength InAs/GaAs quantum-dot laser diode monolithically grown on Ge substrate. *Nature Photonics*, *5*(7), 416-419.

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