Researchers get better metrics on laser potential of key material

July 25 2013

Researchers from North Carolina State University have developed more accurate measurements of how efficiently a polymer called MEH-PPV amplifies light, which should advance efforts to develop a new generation of lasers and photonic devices.

"By improving our understanding of this material, we get closer to the longstanding industry goal of using MEH-PPV to create cheaper, more flexible photonic technologies," says Dr. Lewis Reynolds, a teaching associate professor of materials science and engineering at NC State and senior author of a paper describing the research. MEH-PPV is a low-cost polymer that can be integrated with silicon chips, and researchers have long sought to use the material to convert electricity into laser light for use in photonic devices such as optical amplifiers and chemical sensors.

At issue is MEH-PPV's "optical gain," which is a way of measuring how effectively a material can amplify light. Understanding a material's optical gain is essential to laser development.

Researchers determine the optical gain of MEH-PPV by pulsing laser light into the material and measuring the light that the MEH-PPV then produces in response. The NC State team used extremely short laser pulses – 10 laser pulses per second, with each pulse lasting only 25 picoseconds. To get a grasp of how short those pulses were, it's worth noting that a picosecond is one trillionth of a second.

Previous efforts to determine MEH-PPV's optical gain produced inaccurate results because they used laser pulses that lasted one thousand times longer.

"The longer pulses caused thermal degradation in the MEH-PPV, meaning they led to structural and molecular changes in the material," says Dr. Zach Lampert, a former Ph.D. student at NC State and lead author of the paper. "Essentially, the longer laser pulses were heating the polymer. We were able to minimize these thermal degradation effects, and get a more accurate measurement, by using the picosecond pulses."

"Our new approach is fairly straightforward and can be easily implemented elsewhere," Reynolds says.

More information: *Applied Physics Letters* DOI: 10.1063/1.4816040

Provided by North Carolina State University