Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **333** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Temperature Sensitive Electroluminescence Observed in a Reverse Biased, Frozen Polymer P-I-N Junction

Wednesday 9 June 2021 12:50 (4 minutes)

The solid polymer light-emitting electrochemical cell (PLEC) possesses a polymer homojunction that is reminiscent of a conventional p-n junction but also exhibits distinct features that are profoundly intriguing. The PLEC junction is formed under bias when the propagating p- and n-doping fronts in the semiconducting polymer make contact. The PLEC junction can be immobilized by cooling after the initial junction formation. Once the junction is fixed by cooling, the "frozen-junction"PLEC exhibits a unipolar electroluminescence (EL) and photovoltaic response. Further, the resulting frozen junction can be relaxed, or partially de-doped into a p-i-n junction by controlled manipulation of ion motion. The as-frozen p-n junction can be relaxed with repeated thermal cycles. More precisely, the de-doping was carried out in a single heating/cooling cycle during which a constant reverse bias (RB) current was applied to monitor the extent of de-doping and the magnitude of RB EL. It is on a frozen polymer p-i-n junction that the most puzzling electroluminescent phenomenon was observed. A model is developed that explains the reverse bias EL as caused by the tunnel injection of electrons and holes from bandgap states into a de-doped "intrinsic"region between the p- and n-doped regions. Moreover, the RB EL exhibits hypersensitivity to temperature when the de-doped cell was cooled. There is currently no explanation to this drastic EL enhancement by cooling. Several possible causes have been ruled out through a series of control experiments.

Primary author: WANG, Dongze (Willy) (Queen's University)

Co-author: Prof. GAO, Jun (Queen's University)

Presenter: WANG, Dongze (Willy) (Queen's University)

Session Classification: W2-1 Optical Technology and Communication (DAMOPC) / Technologie optique et communication (DPAMPC)

Track Classification: Atomic, Molecular and Optical Physics, Canada / Physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)