Breakdown of Kasha's Rule in a Ubiquitous, Naturally Occurring, Wide Bandgap Aluminosilicate (Feldspar) - DTU Orbit (17/11/2018)

Breakdown of Kasha's Rule in a Ubiquitous, Naturally Occurring, Wide Bandgap Aluminosilicate (Feldspar)

Excitation-energy-dependent emission (EDE) is well known from photoluminescence (PL) studies of polar solvents and carbon-based nanostructures. In polar solvents, this effect known as the ‘red edge effect’ (REE) is understood to arise from solute-solvent interactions, whereas, in case of carbon-based nanostructures, the origin is highly debated. Understanding this effect has important bearings on the potential applications of these materials. EDE has never been reported from large crystalline materials, except very recently by our group. Here, we make detailed investigations to understand the universality and the mechanism behind the EDE in a wide band gap aluminosilicate (feldspar), which comprises more than half of the Earth's crust, and is widely used in geophotonics (e.g., optical dating). We observe EDE up to 150 nm at room temperature in our samples, which is unprecedented in rigid macroscopic structures. Based on PL investigations at 295 K and 7 K, we present a novel model that is based on photoionisation of a deep lying defect and subsequent transport/relaxation of free electrons in the sub-conduction band tail states. Our model has important implications for potential photonic applications using feldspar, measurement of band tail width in wide bandgap materials, and understanding the EDE effect in other materials.

General information
State: Published
Organisations: Center for Nuclear Technologies, Radiation Physics
Contributors: Prasad, A. K., Jain, M.
Number of pages: 12
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Scientific Reports
Volume: 8
Issue number: 1
Article number: 810
ISSN (Print): 2045-2322
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.36 SJR 1.533 SNIP 1.245
Web of Science (2017): Impact factor 4.122
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.63 SJR 1.692 SNIP 1.354
Web of Science (2016): Impact factor 4.259
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 5.3 SJR 2.034 SNIP 1.597
Web of Science (2015): Impact factor 5.228
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 4.75 SJR 2.163 SNIP 1.554
Web of Science (2014): Impact factor 5.578
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 4.06 SJR 1.998 SNIP 1.57
Web of Science (2013): Impact factor 5.078
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.44 SJR 1.531 SNIP 0.962
Web of Science (2012): Impact factor 2.927
ISI indexed (2012): ISI indexed yes