Development of Rechargeable Afterglow Substrates With Slow to Rapid Decomposition Kinetics

Abstract: Chemiluminescence is defined as the generation of light upon a chemical reaction. After the incorporation of electron-withdrawing motifs into Schaap's scaffolds, 1,2-dioxetane-based afterglow substrates have found utility across a range of applications due to their ability to produce persistent luminescence for an extended period, ranging from minutes to hours after the cessation of external light irradiation. Leveraging this unique mechanism, we initially developed organic afterglow substrates, namely nanotorches, which display persistent luminescence for over 10 days following a single irradiation.. The nanotorch could be charged remotely by 660 nm light in a non-invasive manner, which exhibited great potential for real-time tracing the location of macrophage cell-based microrobots. Further, afterglow substrates were modified with heavy atoms to eliminate the necessity of a photosensitizer, while the adamantyl group was replaced to promote decomposition kinetics. The enhanced characteristics of recently prepared afterglow substrates enable deep tissue imaging, which is inaccessible with traditional slow-decomposing afterglow platforms.