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Microstructured optical fiber based chloride ion sensing method for concrete health monitoring

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Highlights

- The new optical fiber sensor based on suspended core fiber was designed to detect chloride, a linear calibration was obtained.
- The lucigenin/sol-gel membrane with a porous structure was prepared.
- The evanescent field turns out to be strong enough to the optical fiber sensing after simulating by COMSOL.
- Sensor still works even in high alkaline, alkaline environment could promote lucigenin's quenching but sulfate ions have opposite effect.

Abstract: Chloride erosion is the main factor to decrease durability of concrete, it is fairly important to control and monitor chloride in concrete structure. A new sensor based on a suspended core optical fiber was developed to detect the chloride in concrete, in which lucigenin is selected as a fluorescence sensitive material for chloride. A novel type of the sol-gel membrane was introduced to immobilize lucigenin onto the inner wall of the suspended core optical fiber with dip-coating method. The properties of the sol-gel membrane were characterized by scanning electron microscope (SEM) and Fourier transforming infrared (FT-IR), and energy of evanescent field the suspended core optical fiber was calculated by using COMSOL. The fluorescence fluctuations of the optic fiber sensor are chloride concentration-dependent and the relationship between relative fluorescence intensity and chloride concentration follows the Stern–Volmer equation. The linear calibration formulas

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