Vitamins for stable non-fullerene organic solar cells

Vida Engman

SDU Centre for advanced photovoltaics and energy - CAPE
Mads Clausen Instituttet, Det Tekniske Fakultet
University of Southern Denmark
DK-6400 Sønderborg

Organic solar cells have recently broke the power conversion efficiencies limit of 20%, putting the weight on increasing their stability as their last remaining weak point. Their organic nature makes them susceptible to stresses such as oxygen, light, heat and humidity, which are commonly found in their working environment.
Incorporation of stabilizing additives (antioxidants, radical scavengers, hydroperoxide decomposers, UV absorbers) in active layers of organic solar cells is an attractive approach for inhibiting degradation as it is both inexpensive and easily upscalable, and it does not introduce further complexity into the device architecture.
Here we present our recent results on long-term stability improvement using naturally occurring antioxidants, such as vitamin C and beta-carotene, that act as singlet oxygen quenchers and radical scavenging compounds, as well as explore the synergistic effects of such compounds on the mechanical properties. The reported results and methods indicate a desirable route for mitigating degradation in organic solar cells.

References:

1. Atajanov R, Turkovic V et al. The mechanisms of degradation and stabilization of high-performing non-fullerene acceptor based organic solar cells. (in preparation)

2. Balasubramanian S, Turkovic V et al. Vitamin C for Photo-Stable Non-fullerene-acceptor-Based Organic Solar Cells. ACS Appl Mater Interfaces 2021; dx.doi.org/10.1021/acsami.3c06321

3. Prete M, Turkovic V et al. Synergistic effect of carotenoid and silicone-based additives for photooxidatively stable organic solar cells with enhanced elasticity. J Mater Chem C 2021; dx.doi.org/10.1039/D1TC01544C