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Understanding morphological degradation in organic photovoltaics with advanced scattering techniques

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Organic photovoltaics (OPV) have received high attention in recent years as an interesting alternative to conventional solar cells. Recent research efforts focus on enhancing the photovoltaic performance in order to make organic solar cells feasible for industrial purposes. This has led to the development of low band-gap materials with reported power conversion efficiencies surpassing the magic limit of 10 %. [1] However, especially high-efficiency polymers are sensitive to various degradation processes, which strongly decrease their lifetime in comparison to commercially available inorganic photovoltaics. Several issues concerning the optimal thin film morphology and architecture have to be addressed to make organic solar cells a potential candidate for mass market applications. The work of our group takes a deeper look at the morphologically induced aging processes of photoactive materials during operation of OPV devices, using in-operando GISAXS and GIWAXS. [2-5] Following the photovoltaic and structural properties of the devices simultaneously with advanced scattering techniques gives valuable insights into the degradation pathways inside the photoactive organic layer.

- [1] Zhao, et al., Nat. Energy 1 (2016)
- [2] Schaffer, et al., Adv. Mater. 25, 46 (2013)
- [3] Wang, et al., J. Mater. Chem. A 3 (2015)
- [4] Schaffer, et al., Adv. Energy Mater. 6, 9 (2016)
- [5] Moseguí González, et al., ACS Appl. Mater. Interfaces 9, 4, (2017)

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