

Cherry-Picking Micrographs: A Critical Perspective on Scientific Publishing Practice

Martin Wortmann¹, Ashley S. Layland², Natalie Frese¹, Uwe Kahmann², Timo Grothe³, Jan Lukas Storck³, Tomasz Blachowicz⁴, Bruno Hüsgen³, Andrea Ehrmann³

¹ Faculty of Physics, Bielefeld University, 33615 Bielefeld, Germany

² Zentrum für Ultrastrukturelle Diagnostik, 33615 Bielefeld, Germany

³ Faculty of Engineering and Mathematics, Bielefeld University of Applied Sciences, 33619 Bielefeld, Germany

⁴ Institute of Physics — Centre for Science and Education, Silesian University of Technology, 44-100 Gliwice, Poland

Highly magnified micrographs are part of the majority of publications in materials science and related fields. While occasionally used only to give an idea of structural details of a sample, in many cases such micrographs are the basis for discussions and far-reaching conclusions on the nature of a specimen. In both cases, reviewers demand and researchers deliver only the bare minimum of micrographs to substantiate their research hypothesis. The peer review system creates strong incentives to cherry-pick micrographs for publications, which contributes to the so-called reproducibility crisis [1]. This talk will address the causes and effects of biased micrograph selection and possible steps to improve the status quo. Heterogeneous poly(acrylonitrile) (PAN) nanofiber nonwovens with embedded nanoparticles were used to demonstrate how an insufficient or biased micrograph selection may lead to erroneous conclusions. Different micrographs taken by transmission electron microscopy (TEM) and helium ion microscopy (HIM) with sometimes contradictory implications were analyzed and used as a basis for micro-magnetic simulations [2].

[1] Baker, M. (2016). Reproducibility crisis. *Nature*, 533(26), 353-66.

[2] Wortmann, M., Layland, A. S., Frese, N., Kahmann, U., Grothe, T., Storck, J. L., ... & Ehrmann, A. (2020). On the reliability of highly magnified micrographs for structural analysis in materials science. *Scientific reports*, 10(1), 1-8.

