

Type of presentation: Oral

IT-12-O-1893 Secondary electron quasi-simultaneous observation of energy selective imaging and diffraction in DualEEM

Grzelakowski K. P.¹

¹OPTICON Nanotechnology, Wroclaw, Poland

Email of the presenting author: k.grzelakowski@opticon-nanotechnology.com

We present the first results of the AES application in the novel technique based on PEEM [1] and LEEM [2] concepts: DualEEM [3].It utilizes the idea of the imaging α - Spherical Deflector Analyzer (α -SDA) [4] with the total deflection 2π .The image returns exactly to its origin on the optical axis independently of the starting angle and energy.As a consequence,the object of filtration and its image are invariant in the 2π deflection process. Additionally, the final angles of incidence at this plane change the sign after the full angle deflection,which indicates mirroring-like effect.This mathematical analogy to the classical mirror operator is further enriched by the unique property of the α -SDA analyzer: the direction of electron propagation before "reflection" at the symmetry plane is preserved after the 2π deflection process is completed.Therefore, contrary to the classical electrostatic mirror,the propagation direction on both sides of the mirror plane is preserved.This could be referred to as a unique "through the looking-glass" electron optical effect.Thus, the α -SDA imaging analyzer exhibits all the advantages of the electrostatic mirror without the loss of beneficial linear geometry.The α -SDA assures not only the selection of characteristic energy for imaging, but also a beam separation into two imaging channels: energy-selective real image and reciprocal (diffraction) image and their quasi-simultaneous acquisition.The microscope is equipped with an Auger electron gun located inside the immersion objective lens that allows for an unique electron beam sample illumination and thus,opens a new application field for electron spectromicroscopy under laboratory conditions.For the first time that unique kind of the sample illumination is used for the energy selective Auger electron imaging and diffraction. Both are visualized at two independent imaging channels:one for the real and the other for the reciprocal image.These images are acquired quasi-simultaneously through software based switching of on and off potentials of the one of hemispheres of the α - spherical deflector analyzer.The first results are reported and discussed.

1 E. Brueche, Z.Phys. 86 (1933) 448,

2 E. Bauer, in Proc.of the 5th Int. Congr.for El.Micr.,(Academic, N.Y., 1962, p.D-11)

3 K.P. Grzelakowski, Ultramicroscopy, 130 (2013) 29; 4 Ultramicroscopy 116 (2012) 95

Acknowledgement: The author acknowledges the financial support by the NCBR in Warsaw. My thanks are also due to Krzysztof Wojcik and his team at "Metob" for the excellent machining and advice. I am very grateful to Prof.Ernst Bauer for his valuable suggestions and discussions. I would like also to express my gratitude to Janusz Krajniak for his dedication to this project and Dariusz Mirecki for his support.

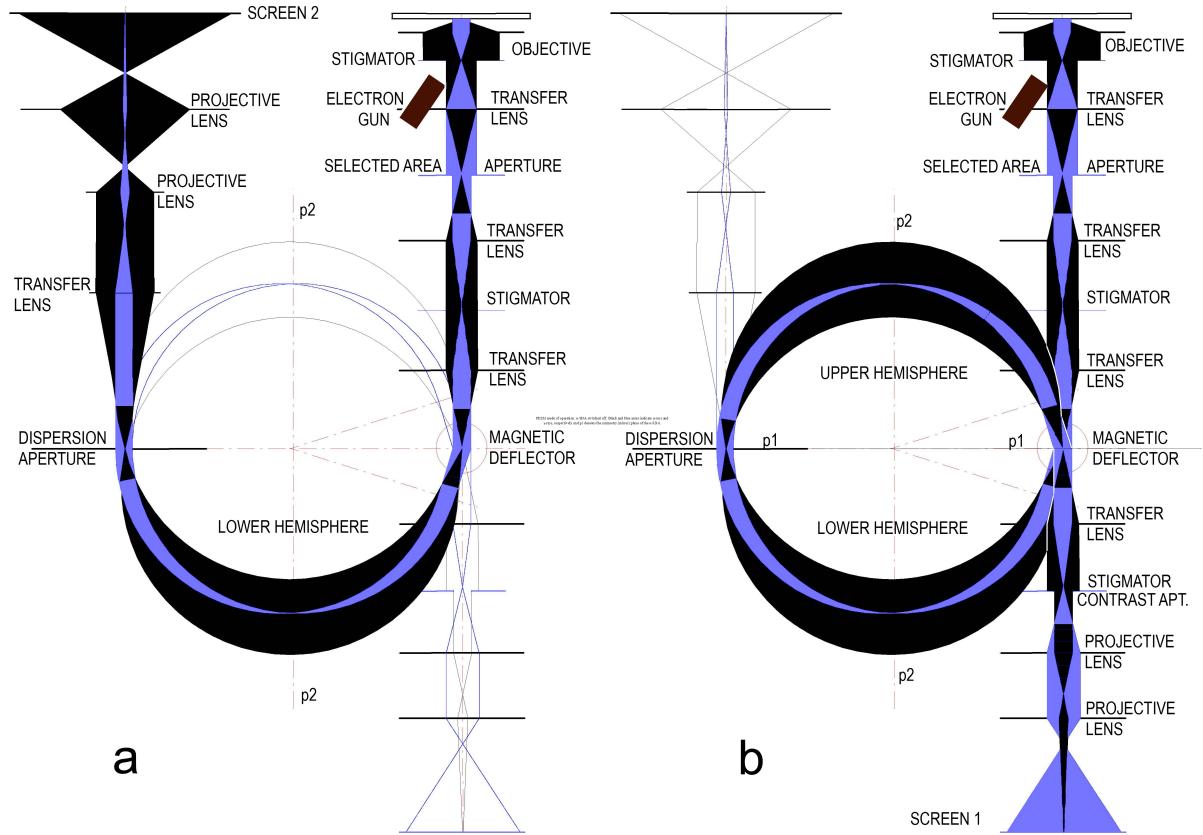


Fig. 1: Black and blue areas indicate α -rays and γ -rays, respectively, p1 and p2 denote the symmetry and diffraction planes of the α -SDA, respectively: (a) energy selective k-projection, upper hemisphere switched off, (b) energy selective real image mode, lower and upper hemisphere switched on. PEEM mode: α -SDA switched off (right hand part of Fig.b).