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SEM History

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Manfred von Ardenne was an EM pioneer and the first to publish a complete concept of a scanning electron microscope. A German overseas newscast reported the death of Manfred von Ardenne on 28 May. During the 1930s he was involved in cathode ray work and later lived in East Germany and did significant cancer research. Not mentioned in the newscast was his conceptual development of the SEM in the late 1930s.

He outlined the underlying principles of SEM operation: an electron probe scanning a small region of the specimen, the emitted electrons are captured, amplified and time-sequentially displayed on a cathode ray tube. Magnification is the ratio between the areas scanned and displayed. His was the fantastic notion of a microscope without a magnifying lens.

There are two earlier SEM related papers by Knoll, but they were short and specific to secondary electrons only and not in the context of an SEM. Incidentally, Knoll was Ernst Ruska's supervisor. Ruska with Knoll built the first EM (TEM) in 1931.

Von Ardenne's article entitled "Des Elektronen-Raster-Mikroskop" was published in the "Zeitschrift Technischen Physik" 19, (1938) 407-416. (In English the title reads "The Scanning Electron Microscope".) It is astonishing that this was published some 27 years before the first commercial SEM was produced.


It is interesting that the now more complex TEM was developed from the practical TEM in 1933 (the first with a specimen port) and was a high performer in the early 1950s. Only in about 1960 was the Cambridge group, under Oatley, able to build the first SEM and the first commercial SEM was produced by Cambridge Instrument Co. in 1965.

A lot of technology (especially TV/CRT and the secondary detector) had to mature before SEM was possible and the Cambridge group deserves great credit. But the development of several unique concepts of a then quite futuristic instrument is to von Ardenne's enduring credit.

After posting a note on the microscopy server, the writer received an email from Thomas Everhart, the co-inventor of the secondary detector:

"Your note about von Ardenne was forwarded to me. While I agree with what you write, you might note that Stinzing received a German patent on the concept of the SEM in about 1929, if memory serves me right. So far as I know, he did nothing to reduce the concept to practice. Knoll also used the concepts in the mid thirties, slightly before von Ardenne got involved. However, von Ardenne was the first to get serious about resolution in the SEM and he did have many ingenious ideas." ■

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