

## This Week's Citation Classic

Chu W K, Mayer J W, Nicolet M A, Buck T M, Amsel G & Eisen F.

Principles and applications of ion beam techniques for the analysis of solids and thin films. *Thin Solid Film* 17:1-41, 1973; and 19:423, 1973.

[California Inst. Technol., Pasadena, CA. Bell Telephone Labs, Murray Hill, NJ. Groupe de Physique des Solides de l'E. N.S., Paris, France. Science Center, Rockwell Internat., Thousand Oaks, CA]

This paper reviews in principle and by examples how a collimated monoenergetic ion beam incident on a target provides information on its structure and composition when the energy of the backscattered ion or particle generated by nuclear reactions, is analyzed. [The **SCF**<sup>®</sup> indicates that this paper has been cited over 195 times since 1973.]

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"Nuclear physicists have realized the analytical power of ion beam for more than 50 years. Somehow it took quite a while to spread this powerful and versatile technique to the other disciplines. It was not until the late 1960s that ion beam analysis had taken a foothold. The need was there partly due to the fast growth of planar technology in semiconductor. The tools were there due to the invention of a solid-state particle detector and electronic system for data handling, processing, and storage. The motivation was there due to the discovery of channeling phenomenon and recognition of ion implantation in material doping and alteration. And most of all, the mood was there. The granting agencies are slowly drifting their funds from the esoteric to the relevant.

"I had learned the basics of ion beam physics from Darden Powers at Baylor

University where I did my thesis work on stopping power measurement by backscattering from thin metal films of known thickness. After a three-year postdoctoral fellowship at Baylor, I went to Caltech in 1972 as a research fellow in the electrical engineering department, learning ion implantation and channeling from Jim Mayer and Marc Nicolet. We blundered into many interesting subjects related to semiconductor materials. In 1972, we got an invitation to prepare a review talk about nuclear backscattering at the 1973 Chicago Electrochemical Society Meeting. Later on we were asked to merge our paper with three other papers from Tom Buck, Georges Amsel, and Fred Eisen. None of us had written our paper yet. Every one assumed the other would be the anchor writer. After the exchange of many letters, telegrams, and cross-Atlantic telephone conversations, we finally had our joint review paper finished. We felt relieved and happy about the paper. However the paper was rejected by the ECS because we exceeded the page limit by 200%. We submitted this rejected long review to *Thin Solid Film* and quickly wrote a shorter one with emphasis on the study of Si related material for ECS.

"During the Chicago 1973 ECS meeting, Jim had to be in Europe working and lecturing, and Marc had class to teach at Caltech. Besides he had to stay at Pasadena to manage our hectic research activities. I went and presented the talk which became my first invited talk. Later on we expanded the materials into a book, *Backscattering Spectrometry*, published by Academic press in 1978.<sup>1</sup>

"To look back, I feel very lucky that I had good teachers and a chance to get involved in many exciting projects, and to interact with and to learn from many excellent colleagues who helped me to grow in my career."

1. Chu W K, Mayer J W & Nicolet M A. *Backscattering spectrometry*. New York: Academic Press, 1978. 384 p.