

Nitrogen Depth Profile in Nitrided Steel

Some steels such as those used for gearing are often nitrided by diffusing nitrogen to depths as much as 500 microns. The advantage of nitriding over carburization is that the steel does not need heat treating after nitriding, so better control of dimensions is possible.

Depth measurements of nitrogen content can be difficult due to the limited response of Energy Dispersive Spectrometers (and conventional curved crystal WDS) to Nitrogen x-rays. Fig. 1. shows data obtained with EDS using 5 minute counts to try to get good statistics, and although some depth data can be obtained, a real depth map would take a long time. Fig. 2 shows similar data obtained using the Parallax LoMAX optic on the EDS detector which increases the sensitivity for Nitrogen by 2-3X. The dead time was higher using the LoMAX because the LoMAX also increased the Fe (L) lines. By contrast, data obtained using the HEXS spectrometer (Fig. 3) is much better due to the increased sensitivity of HEXS to Nitrogen x-rays. Each data point in fig. 3 is an average of 10 1-second counts and the short acquisition time makes it possible to quickly obtain a depth profile of the Nitrogen.

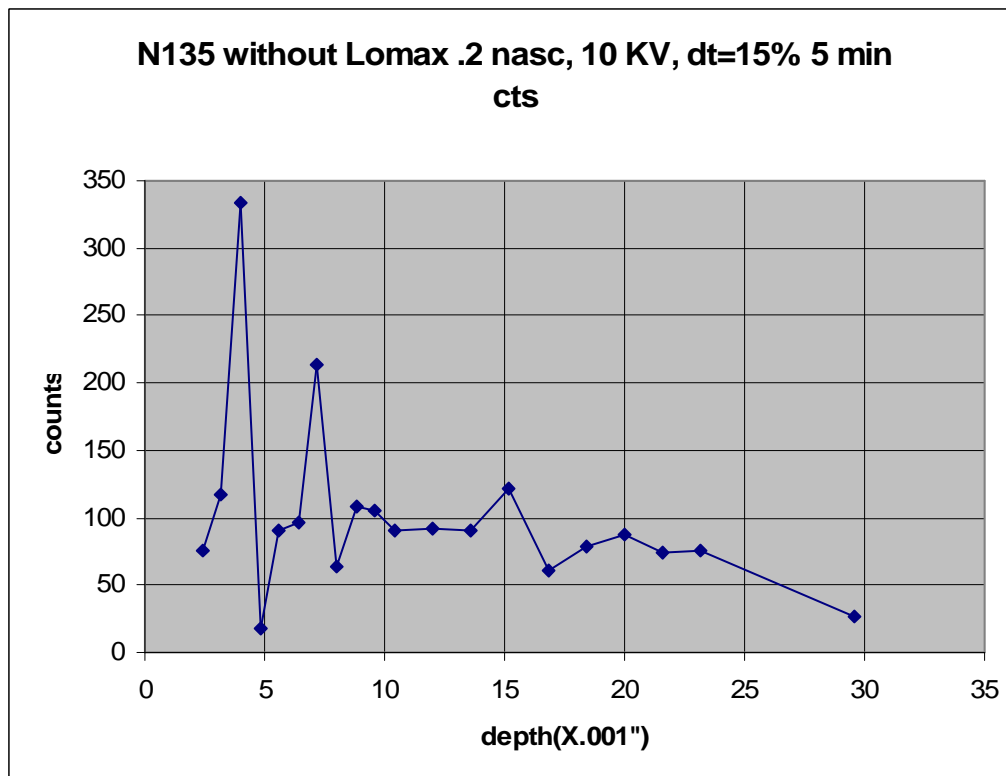


Fig. 1. Nitrogen depth profile using EDS without LoMAX. Each data point required 5 minutes.

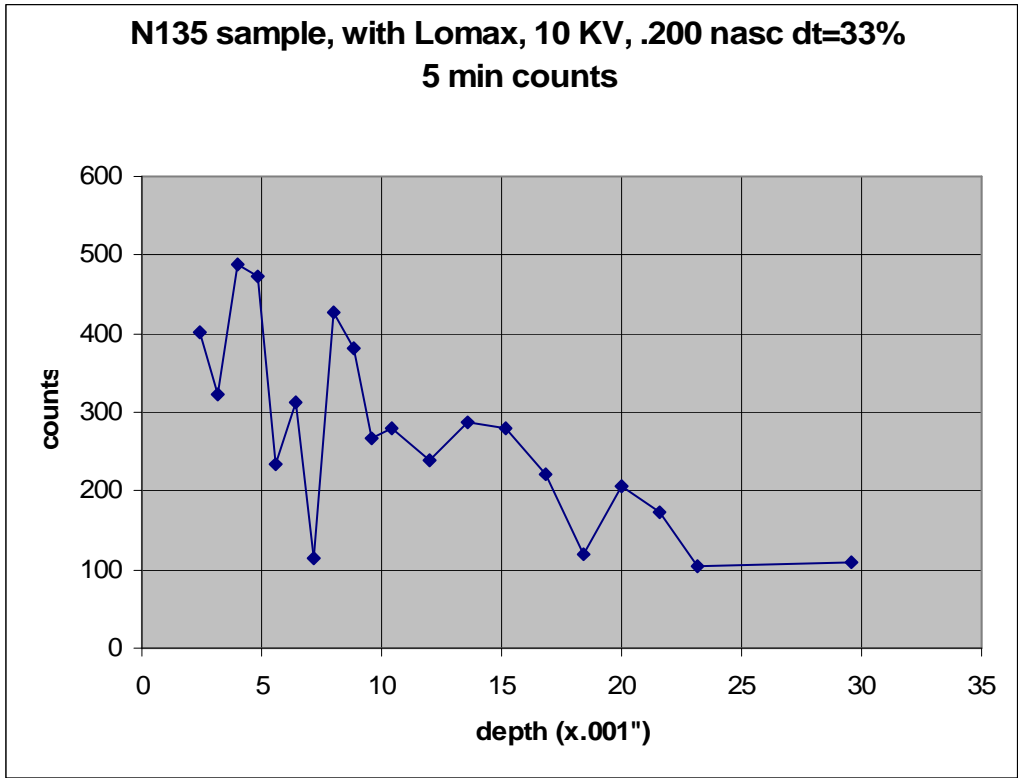


Fig. 2. Nitrogen depth profile with LoMAX on EDS. Each data point required 5 minutes.

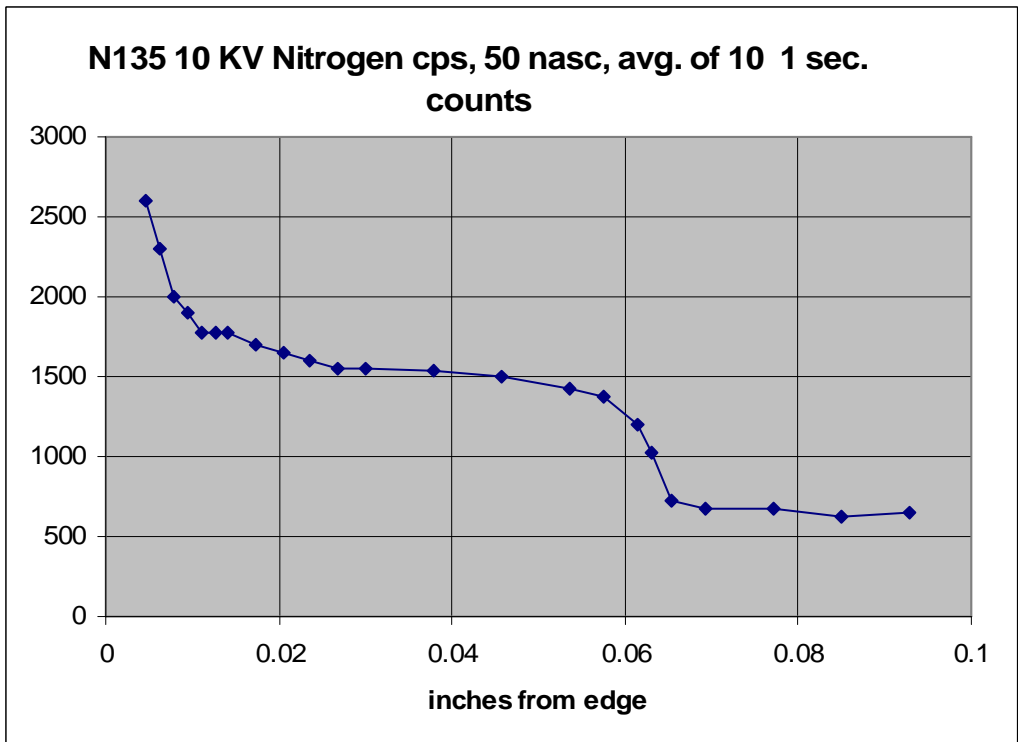


Fig. 3. Nitrogen depth profile using HEXS WDS. Each data point required 10 seconds.