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Certified to ISO-9001 and 17025

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NiCr-3

NiCr-3 - Ni-Cr Depth Profiling Standard

Geller MicroÅnalytical Laboratory announces the availability of a standard for determining instrument induced broadening of interfaces from ion beam sputtering (among other techniques). This standard is very similar to that which was previously available from NIST, the SRM-2135a which consists of 5 layers of Cr and 4 layers of Ni.

The NiCr-3 standard consists of 6 layers of Cr and 6 layers of Ni on a polished silicon wafer. The individual layer thicknesses are nominally 53 nm for the Cr and 64 nm for the Ni. Representative depth profiles from NiCr-3 vs. SRM-2135a taken under the same conditions (with rotational depth profiling [1] using 3kV Ar+) can be seen in figures 1 and 2. The layer thicknesses and interface widths are in good agreement.

The standard was made by ion assisted deposition with dual Kaufmann type ion guns at a partial pressure chamber of 1 X 10^{-4} torr (argon backfill). Base pressure before cleaning and deposition was 6 X 10^{-7} torr. The substrate was first pre-cleaned using Ar+ followed by depositions of Ni (99.9%) and Cr (99.9%). The depositions were monitored by a quartz crystal balance. From fixturing there are small amounts of Al (1.3%), Fe (2.7%), and Mo (1.0%).

The total thickness of the deposited layers of NiCr-3 was measured using the "breakthrough" method. With this method the films are ion sputter removed in a crater 400µm in diameter. The crater depth was measured using a stylus profilometer (Dektak 3030) calibrated against a traceable thickness standard. The resulting crater was 754 nm deep.

The mass density of Cr and Ni was measured using electron beam excitation and measuring characteristic x-ray intensities. This technique was first used to measure NIST SRM-2135a to determine accuracy. The NIST non-certified thickness for the 9 layers is 518 nm (using theoretical densities). As indicated in the NIST certification, the density of sputter deposited materials may be less than theoretical density, resulting in thicker films. Our program measures 536 nm (3.5% high). Measured in this manner, the NiCr-2 has a total thickness of 700nm, with a maximum variation across the 75mm wafer of ±2%.

Interface widths of successively appearing nickel layers have been measured using the NIST "Logit" program (10-90% definition). Results from the NIST-2135a vs NiCr-2 are tabulated below. These measurements indicate that the interface widths of NiCr-2 are marginally greater than measured with SRM-2135a. The currently available standard, SRM-2135c is from a newer production run and may have different interface widths.

Ni layer	Edge	Center	Edge	SRM-2135a
1	6.5	6.2	6.9	6.2
2	7.8	7.4	8.0	6.3
3	7.8	8.5	8.5	6.7
4	7.8	8.0	8.9	7.4
5	7.8	8.3	8.9	
6	8.3		8.3	

Interface widths (10-90%) of successively appearing Ni layers. Units are in nanometers.

NiCr-3 is offered as approximately 1 X 3 cm. Rectangles @ $600.00.

[1] N. Veisfeld & J.D. Geller, "Ion Sputtering Yield Measurements for Submicrometer Thin Films", JVST, Vol. 6, Number 3, Part II, May/June 1988.

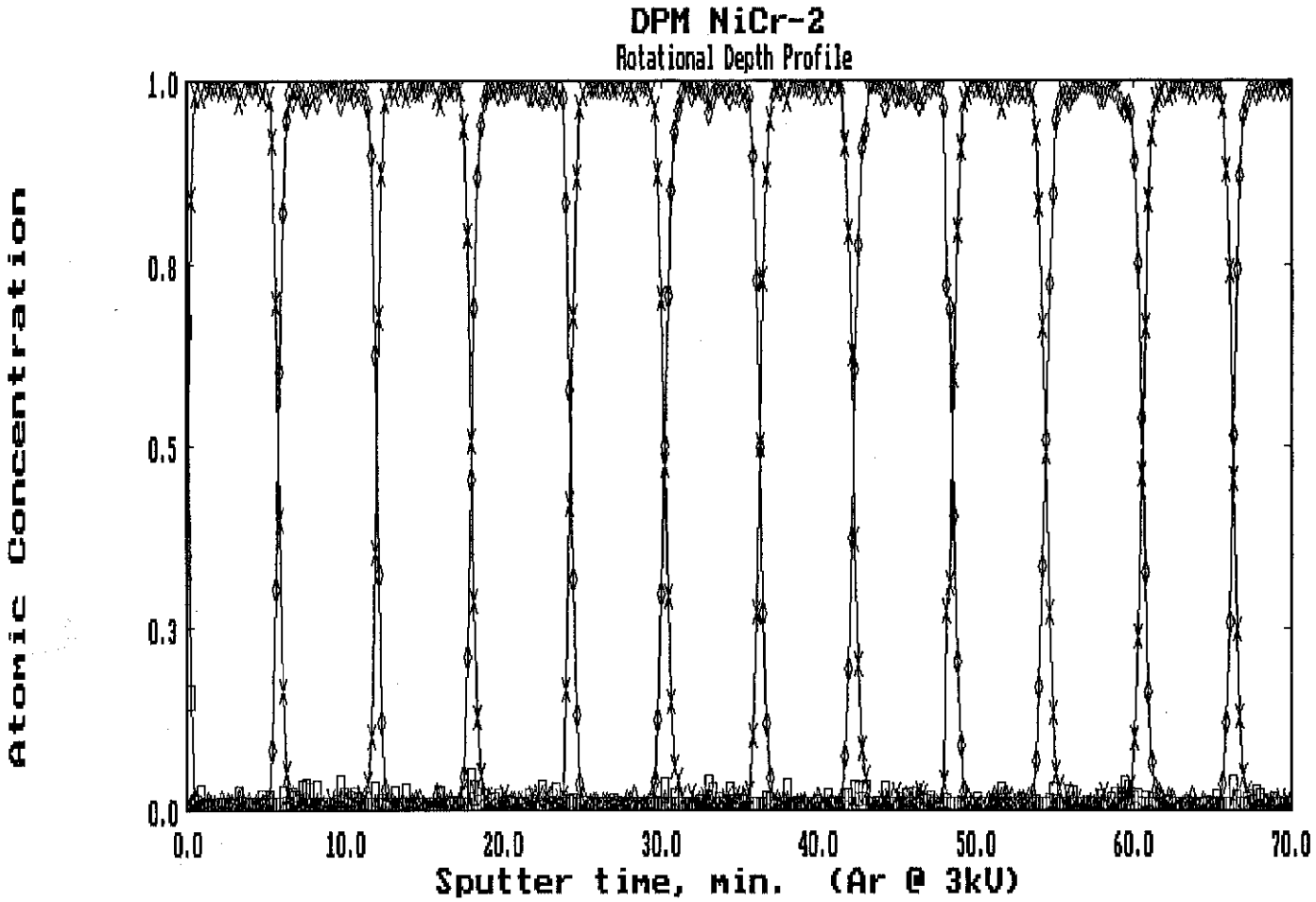

Figure 1

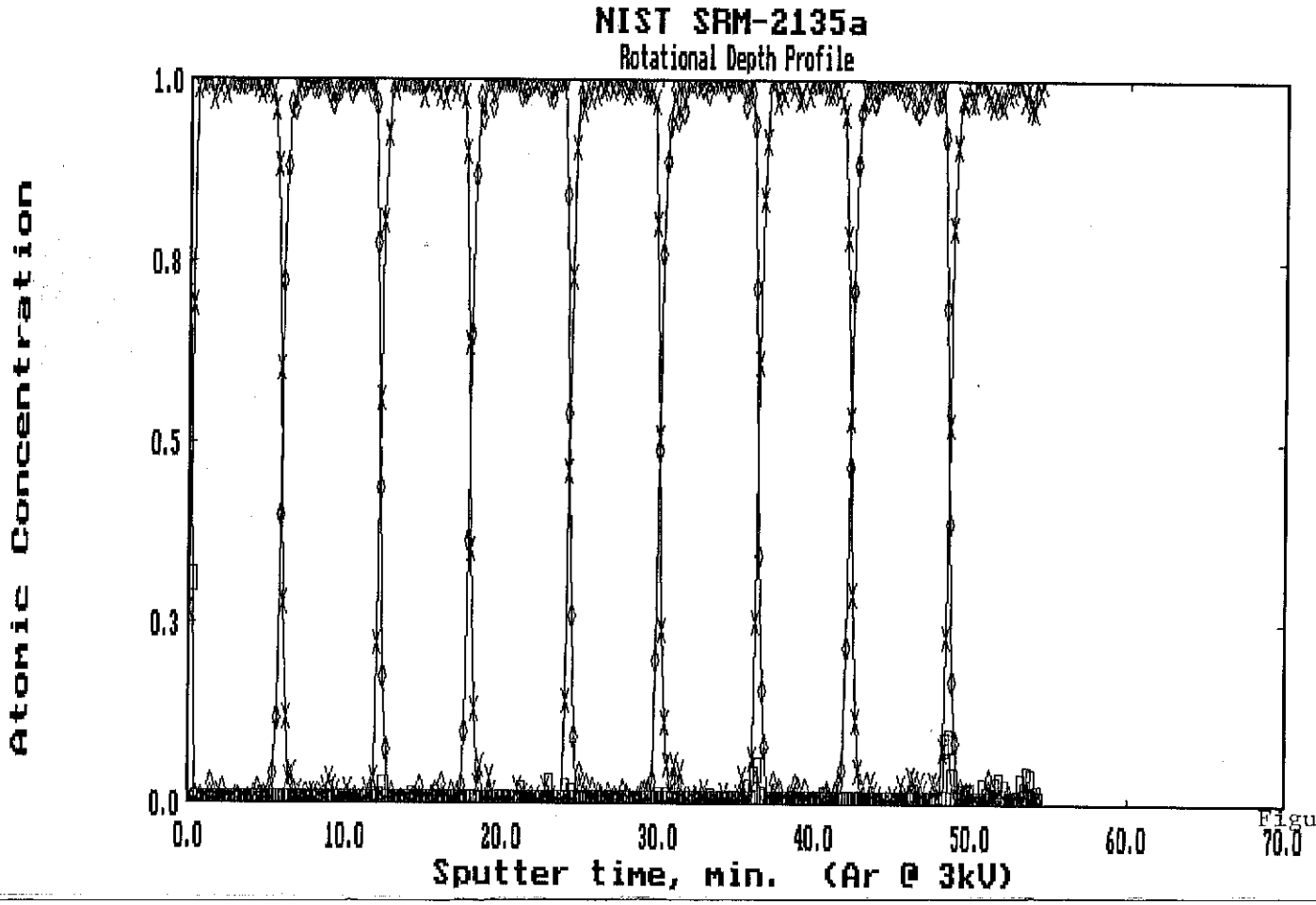

Figure 2