MÖSSBAUER EFFECT OF THE 6.25 keV RESONANCE OF ^{181}Ta IN A PLATINUM MATRIX

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We report the observation of the Mössbauer effect of the 6.25 keV state in ^{181}Ta using a host matrix of platinum.

The Mössbauer effect of the 6.25 keV state in ^{181}Ta has been observed thus far only in host matrices of Ta and W in spite of many attempts with other materials [1-3]. It was questionable whether the absence of resonances were due to excessive line broadenings originating from disturbances in the host matrices or due to the fact that the isomer shifts fall beyond the typical range of velocities employed in those experiments.

We report here the observation of the resonance with a source of ^{181}W in platinum against a tantalum metal absorber. The room temperature spectrum is shown in fig. 1 and consists of one line positioned at -2.65 ± 0.05 mm/sec with a width of 0.38 ± 0.04 mm/sec. This indicates, together with the previously measured resonance of ^{181}W in W, that isomer shifts of metallic matrices are principally of the same order of magnitude as the presently achievable linewidths.

The source material was a platinum foil of 99.99% purity annealed for 50 hours at 1150°C in ultra high vacuum. The ^{181}W activity consisted of WO_3 dissolved in $NH_4(OH)$. It was first deposited as a droplet on the surface of the platinum foil, then reduced in a hydrogen stream and finally diffused into the metal by heating at 1250°C for two hours.

As absorber served a 4.6 mg/cm^2 thick tantalum foil produced in a similar way as described by Sauer et al. [3]. In a separate study we obtained a value of Γ_{exp} = 0.069 mm/sec for the linewidth of the absorber described above and a source of ^{181}W in a W single crystal. This

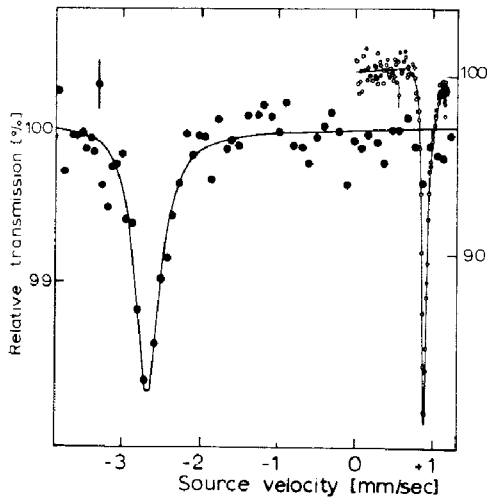

Fig.1. Absorption spectrum of a source of ^{181}W in Pt against a Ta metal absorber. The solid line represents a least squares fit to the data (solid circles).

The spectrum at +0.9 mm/sec (open circles) indicates size and position of the resonance of a source of ^{181}W in W against the same absorber. Here the dispersion term (5) is clearly visible.

compares to a value of Γ_{exp} = 0.075 mm/sec reported by Taylor et al. [4]. Our value is still about 10 times the minimum observable linewidth $2\Gamma_{nat}$ = 0.0064 mm/sec. The total effect in this experiment was 20% of the counting rate. A proportional counter filled with 350 torr argon and 150 torr crypton showed the best efficiency for the detection of the 6.25 keV gamma rays.

Studies of other host systems are in progress

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