MEASUREMENT HEAD WMR-9

Measurement of basis weight (gr/m2)

The measurement of basis weight relies on beta and in special cases on gamma rays. The method applied is the transmission of the radiation through a web or the reflection (backscattering) of the radiation from the web.

Transmission method

In the transmission method the radiation source is placed on the one side of the web. On the other side is placed the receiver (ionization chamber).

The radioisotope beam after penetration through the web enters the ionization chamber and causes an ionization of the gas which filles the chamber.

The ions are attracted from the high voltage electrodes within the chamber. The ions quantity is sensed as current with idensity proportional to the quantity of ions respective the basis weight of the penetrated web.

The following processes take place in the web:

1. Energy absorption . Energy of the radiated isotopes is absorbed by the web.
2. Elastic impact with the molecules and radiation deflection.

The energy absorption and the losses due to elastc impacts are directly dependend on the web basis weight (gr/m2) and its composition.

(The interactions of the material with radioisotope radiation is in the physical reality more complex than described above. The foregoing presentation is a simplified process description for beta rays aiming to help the rough understanding of principal operation of the measurement heads. If there is any need for a more profound approach, please contact META for associated technical literature).

The relationship between the received current of the ionization chamber and the web basis weight is an exponential one and is given through the function:

G.12

$$I = Io * e^{[(-\mu/\rho)* M]}$$

I = Idensity of measured current with web between transmitter and receiver

Io= Idensity of received curren without web between transmitter and

μ/ρ = Mass absorption coefficient

M = basis weight (mass per area) in gr/m2.

The function is depicted in Fig. G.12.1.

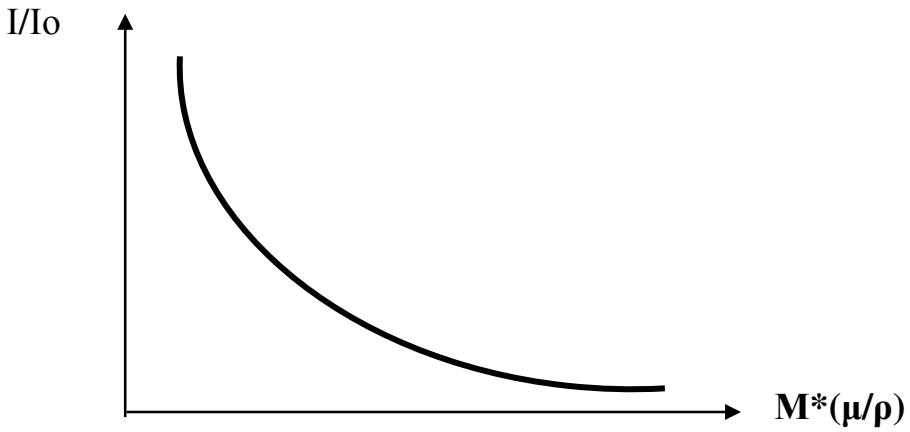

Fig.G.12.1 : Relationship between basis weight and measured current.

The application of radioisotopes as beam sources varies with range of basis weight to be measured. The beta-(β-) rays are used for a basis weight

up to 5,000 gr/m2) .

The gamma-(γ-) rays are used to measure weights beyond this range.

The heads of WMR-9 are built to be equipped with following radioisotope sources, depending on the material to be measured:

1.Promethium, PM-147 (beta rays)
2.Krypton, Kr-85 (beta rays)
3.Strontium , Sr-90 (beta rays)
4.Iron, Fe55 (gamma rays)
5.Americium, Am241 (gamma rays)

Technical specifications

Basis weight Max Range	Source	Energy	HLT [years]	MG [mm]	Min.M.S. [↓mm]
140 gr/m2	Pm147	3.7 GBq	2.65	12	4 mm
1000gr/m2	Kr85	3.7-14GBq	10.4	9-20	15 mm
5000gr/m2	Sr90	370-740MBq	28	20	15 mm
35 kg/m2	Am241	500 mCi	470		

HLT: Half Life Time of radioisotope.
MG: Measuring Gaps between transmitter-receiver.
Min. M.S. : Minimum possible Measuring Spot.

(Fe55 is used for inert material measurement like ash etc.).

WMR-9: Head Configuration (Pm147/Kr 85/Sr90)

The head system consists of the head which incorporates the radioisotope cage with the source and the head with the ionization chamber and receiver electronics.

The measuring gap between both heads is designed for 9.5 mm. The heads components are diagrammatically depicted in Fig. G.12.2.

The temperature sensing elements for temperature compensation of the measuring gap are not shown.

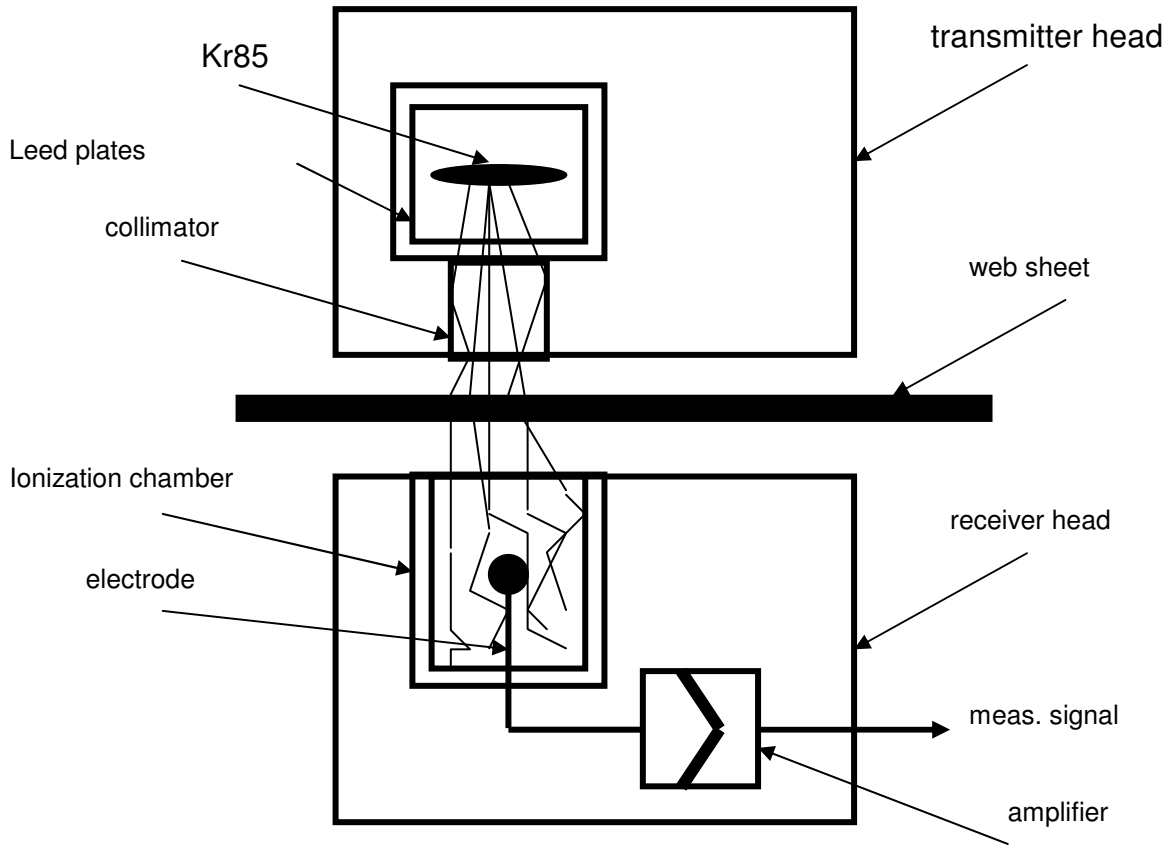

Fig. G.12.2: WMR-9 , Head Configuration