Diagnostic X-ray shielding

X-rays were first discovered in 1895. Medically, the first recorded use of a diagnostic X-ray came just six months later in Massachusetts, United States. Over 100 years on, we now know X-rays to be a form of ionizing radiation which, in these health-conscious days, is considered undesirable for the human body. Pilkington Med-X™ has been designed to provide a high quality, transparent protective shield against X-ray radiation; its high lead and barium content gives optimum shielding against radiation from equipment in the 100 to 300kV range.

Shielding medical staff performing X-rays with Med-X™

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PILKINGTON SPECIAL GLASS

X-rays were discovered and named by Wilhelm Conrad Roentgen in 1895, and revealed to the world in the communication "Über eine nue Art von Strahlen" (On a New Kind of Rays) in the proceedings of the Würzburg Physico-Medical Society in December of that year. 'X' represented the then unknown nature of these rays.

Over 100 years on we now know X-rays to be a form of ionizing radiation, which have wavelengths between around 0.1 and 100Å.

Bombarding a metal target with high-energy electrons can generate X-rays.

Energy in the form of X-rays will then be released in two ways: via Brehmsstrahlung (Ger. 'braking radiation'), whereby interaction with the metallic nucleus causes a loss of velocity of the incoming electron - the loss of energy being in the form of X-rays; or by K-shell emission where the incoming electron displaces atoms within the inner electron shell, enabling an L-shell electron to fill this hole, in the process losing energy emitted an an X-ray. Brehmsstrahlung has a broad energy spectrum whereas the K-shell emission produces X-rays of characteristic energy dependant upon the atom involved.

MEDICAL USE AND HAZARDS

One of Roentgen's earliest discoveries was that although X-rays could penetrate soft tissue they were absorbed by denser materials including bone. The first recorded use of a diagnostic X-ray was as early as February 1896 in Massachusetts, United States, when Dr. Gilman Frost was able to diagnose a fracture in a man named Eddie McCarthy, from a plate produced by his brother Edwin Frost.

Medical X-rays are characterized both by the tube current and by the accelerating voltage applied to the electrons.

The tube current (mA) dictates the flux of electrons striking the target and, hence, the number of X-rays produced; the accelerating voltage (kVp) dictates the energy of the resulting X-rays and, hence, their penetration.

Med-X™ used for viewing windows in X-ray rooms

Taken together, the mA and kVp of the X-ray source contribute to the radiation dose.

X-rays are ionizing radiation - that is, they are of sufficiently high energy to be able to strip electrons from atoms.

In the human body this process leads to the formation of free radicals which, in these health-conscious days, are known as an undesirable presence in the human body.

While it must always be remembered that the risks of X-ray induced damage to the patient is almost certainly outweighed by the risks of not having the X-ray, medical staff performing the X-rays, by presumably repetitive exposure, are not advantaged in any way.

Hence the requirement for radiation protection.

X-RAY PROTECTION

As we have already said, solid matter can absorb X-ray radiation. The degree of absorption can be simply described by the Beer-Lambert law:

- $I = I_0 e^{\mu t}$
- I = intensity
- I_0 = initial intensity
- μ = absorption coefficient
- t = path length

As a general rule, the absorption coefficient m increases with atomic number.

However, there is also a wavelength dependency of this absorption coefficient for any given element - which complicates proceedings. Each element has characteristic absorption edges, the first of which - the K-edge - lies slightly to the low wavelength side of the K-shell emission for that element.

Absorption rises gradually with wavelength until the absorption edge is reached and then falls dramatically before resuming a steady climb - that is until the next edge is reached.

Because of the wide range of X-ray energies - measured as kVp - required to cover dental, neonatal and general medical X-ray work, protection needs to be offered over the whole range.

Pilkington Med-X™ has been designed for one purpose: to provide a high quality, transparent protective shield against X-Ray radiation. Part of the Pilkington Specialist Glass range, its high lead and barium content gives optimum shielding against radiation from equipment in the 100 to 300kV range.

One of the leading products on the market, Pilkington Med-X™ has undergone extensive research and development, meaning that its comprehensive protection in any medical, technical or research application may be trusted.

Med-X™ benefits

- shields against X-rays from equipment in the 100 to 300kV range;
- high barium and lead content for optimum protection;
- neutral appearance;
- the result of extensive research and development;
- Pilkington quality.

Applications

- viewing windows and insulating glazing in X-ray rooms;
- medical diagnostic screens;
- protection windows in laboratories;
- lenses in safety goggles;
- screens used in airport security measures.

Med-X™ is supplied as polished plates with dimensions of up to 2,500 x 1,250 millimetres, smaller sizes being cut according to customer requirements.

The product is suitable for laminating using PVB interlayers, and can be fitted into sealed doubled glazed units. Med-X™ is available worldwide through local Pilkington sales offices and a network of specialist distributors, many of which carry stock for quick delivery.

Pilkington Special Glass (PSG) is part of *Pilkington plc*, one of the world's largest manufacturers of glass and glazing products for the building, automotive and technical markets. ■

***Worldwide Marketing Manager**
PILKINGTON SPECIAL GLASS

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