

Case Study 1: Magnesium fluoride – MgF₂

Magnesium fluoride is a very commonly used thin film material due to its low refractive index, hardness, and a wide transparency range from the deep ultraviolet to far infrared and is used, most commonly, as a single layer anti-reflection coating on most optical elements.

Conventional deposition requires **high substrate temperatures** of $\approx 300^{\circ}\text{C}$ to achieve stable films thus excluding the application of MgF₂ to all but hard and durable glasses.

Ion Assisted Deposition with Saintech ST series ion sources operating in the *Pulse Mode* produce hard, durable films on unheated substrates. Stable films can now be deposited on polymers and all glasses including very soft high index glasses. Pre-cemented multi-element lenses can now be anti-reflection coated with hard durable coatings that meet the appropriate Mil Specs.

Note that Saintech Ion Beam System models ST3000 and ST55 are the only ion beam systems available that provide Pulse-Mode operation

The deposition of MgF₂, as well as many other fluorides, can considerably benefit from this process. To achieve the ultimate optical properties from this material the *Pulse-Mode* of operation is recommended.

Following is tabulated data comparing the various deposition techniques for MgF₂.

Method of Deposition	Film Properties	Ref. Index @ 550nm
Evaporated – no heating of substrates	Soft and easily damaged Low packing density Highly stressed & unstable	1.34 to 1.37 depends on relative humidity
Evaporated – heated 300°C	More durable, n increasing	1.39 typical
IAD Ar ⁺ , cold substrates	Dense, durable, k increasing	1.40 typical
IAD O ₂ ⁺ full time IAD, cold	Dense, durable, n increasing	1.39 \Rightarrow 1.43 - depends on ion energy and flux
IAD Pulse-Mode, No heating of substrates O₂⁺ bombardment	Hard and Durable High transparency Low stress	1.35 – equivalent to bulk properties

Similar benefits can be achieved with other commonly used vacuum deposition materials.

For further information please contact:

Principal Office:

Saintech Ion Beam Systems

PO Box 3042, Monash Park 2111

New South Wales, Australia

Tel: +612 9817 0466, Fax: +612 9817 0488

Email: info@saintech.com

Web site: www.saintech.com