MULTILAYER X-RAY ASTRONOMICAL OPTICS BY MEANS OF Ni ELECTROFORMING REPLICATION: STATUS PROJECT

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ABSTRACT

We will report on a development project currently on course at the *Brera Astronomical Observatory* with the aim of stating a reliable manufacturing technology for the realization of astronomical optics based on multilayer coatings by means of replication techniques. It should be reminded that multilayer mirrors make not only possible the use of focusing techniques in the hard X-ray energy band (10 – 100 keV) but they can also improve the effective areas of soft X-ray (0.1 – 10 keV) telescopes with respect the usual single-layer high-density material reflectors like Au or Ir used until now. It is foreseen that a number of X-ray astronomy space missions of near future (e.g. *Constellation X* of NASA) will have on board multilayer optics.
Aim of our work is in particular the extension to the manufacturing of multilayer optics of the replication method already successfully utilized for the realization of the high-throughput and good angular resolution mirror optics with Au coating of the Beppo-SAX, JET-X and XMM telescopes. Our approach foresees the realization of an Al mandrel having the negative profile of the mirror to be realized. The mandrel is coated from a thin layer (~ 100 μm) of electroless Ni whose hardness permits to undergo a superpolishing until a *rms* microroughness of 2 Å is achieved. On the mandrel surface is then deposited the multilayer mirror by ion-beam sputtering. Later on the coated mandrel is put into electrolytic bath where a layer of electrolytic Ni is grown in order to give the necessary stiffness to the mirror optics. The mirror is finally separated from the mandrel by cooling it, exploiting the large difference of the thermal expansion coefficients between Ni and Al. In this paper we will describe the technique under development ant we will discuss recent achieved progresses.