THIN LAMINATE WINDOWS

This report is a summary of properties reported in BICEP/Keck XIX: Extremely Thin Composite Polymer Vacuum Windows for BICEP and Other High Throughput Millimeter Wave Telescopes.

OVERVIEW

Thin laminate polyethylene windows are made of layered and compressed high modulus polyethylene (HMPE) with laminating low density polyethylene (LDPE). Triple layer windows (three laminated layers of HMPE) have been used on three BICEP Array receivers with central frequencies at 95, 150, and 220/270 GHz.

SUMMARY OF PROPERTIES

GENERAL

Current maximum diameter:	900mm
Min thickness (single layer HMPE):	0.4mm
Min thickness (double layer HMPE):	0.6mm
Min thickness (triple layer HMPE):	0.8mm

OPTICAL

Index of refraction:	1.53–1.56
Loss tangent at 95 GHz:	≤2.4e-4
Polarization efficiency:	≥99.7%
Cross polarization upper limit:	-25 dB

MECHANICAL

Ultimate tensile strength:	120–135 MPa
Elastic (Young's) modulus:	1.1–1.3 GPa
Strain at Break:	9–12%
Safety factor at sea level (1 atm):	5.7
Permeation rate of atmospheric gas:	1.6e-10 mbar L s^{-1} mm^{-3}