Freedom of FREEFORMS

Fewer elements | Lighter weight | Increased flexibility

OPTIMAX®

Optimax Systems Inc.

Optimax helps its customers prove that great people can do great things with the right technology and support.

We leverage our optics manufacturing technology for programs that benefit mankind and projects that defend our freedom. Our know-how, innovation and speed enable quicker production of precision optics to meet emerging market needs.

What is a **Freeform?**

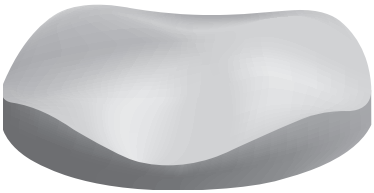
An optical surface with little to no symmetry.

Why design with freeforms?

Designing with freeforms will make your project have:

- Fewer elements
- Lighter weight
- Increased flexibility

And in the end overall better performance.



Freeform

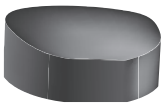
Tolerancing Limits for Freeform Surfaces

Attribute	**Minimum**	**Maximum**
Diameter (mm)	20	500
Characteristics	**Mild** (interferometrically testable)	
	Wild (deviation less than size of part)	
	Extreme (deviation on order of size of part)	

Common **Freeforms**

Toroid

$$Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - C_x^2 X^2 - C_y^2 Y^2}} \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}$$



Atoroid/Biconic

$$Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - (1+k_x) C_x^2 X^2 - (1+k_y) C_y^2 Y^2}} \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}$$

Acylinder

$$Z = \frac{C_x X^2}{[1 + \sqrt{1 - (1+k)(C_x^2 X^2)}]} + a_1 X^2 + a_2 X^4 + a_3 X^6 + a_4 X^8 + a_5 X^{10} \quad C_x = \frac{1}{R_x}$$

Off-Axis Parabola (OAP)

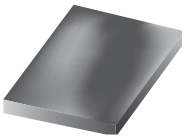
$$Z = \frac{C_x X^2}{[1 + \sqrt{1 - (1+k)(C_x^2 X^2)}]} + a_1 X^2 + a_2 X^4 + a_3 X^6 + a_4 X^8 + a_5 X^{10}$$

$C_x = \frac{1}{R_x}$ *Where k= -1*

Anamorph

$$Z = \frac{C_x X^2 + C_y Y^2}{1 + \sqrt{1 - (1+K_x)(C_x^2 X^2) - (1+K_y)(C_y^2 Y^2)}} + AR[(1-AP)X^2 + (1+AP)Y^2]^2$$

$$+ BR[(1-BP)X^2 + (1+BP)Y^2]^3 + CR[(1-CP)X^2 + (1+CP)Y^2]^4 + DR[(1-DP)X^2 + (1+DP)Y^2]^5 \quad C_x = \frac{1}{R_x} \quad C_y = \frac{1}{R_y}$$



XYZ Freeforms or Solid Model

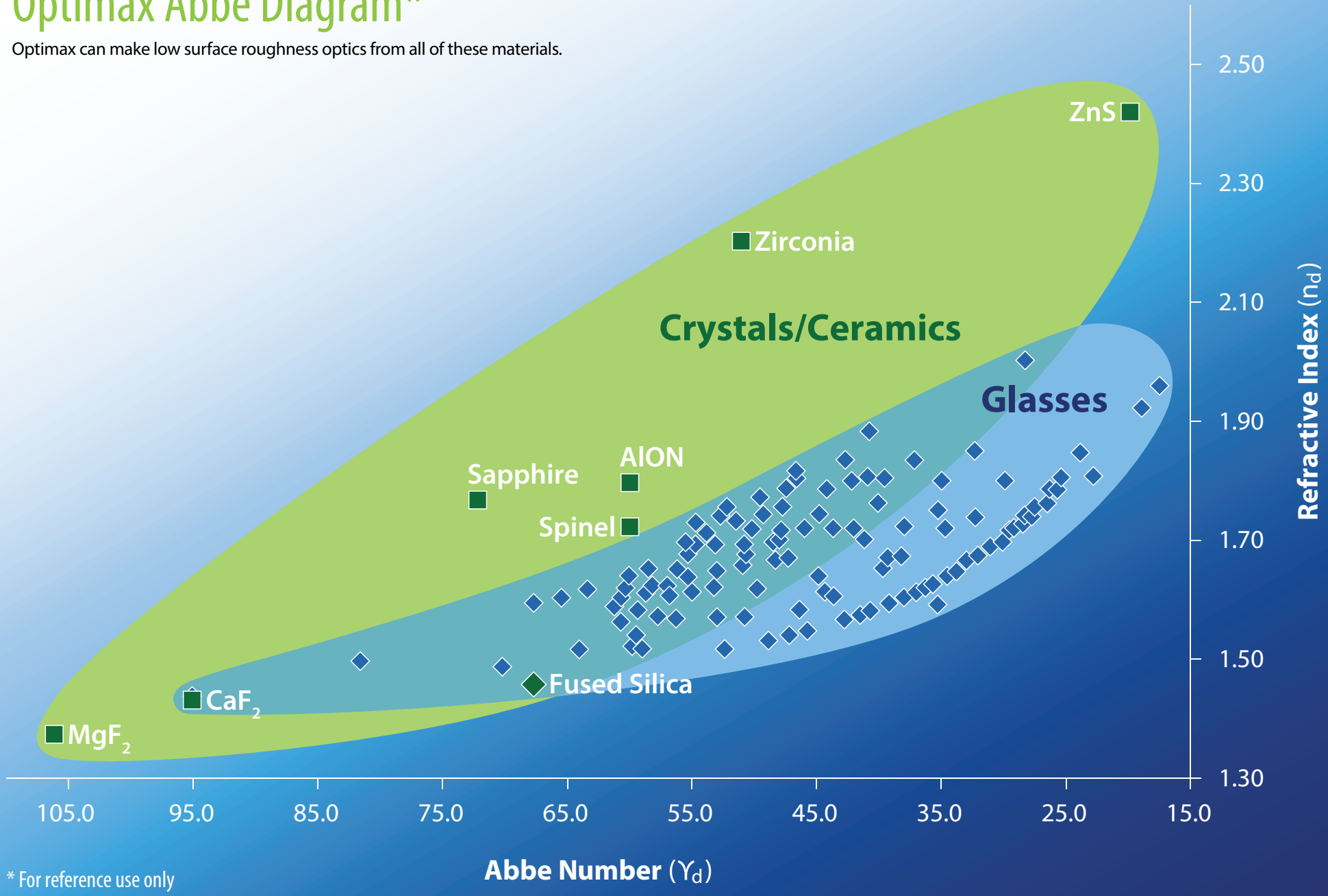
Freeform: Surface created from point cloud or solid model.

Other Equation Based Freeforms

Zernike Polynomials, XY Polynomials, etc.

Optimax Abbe Diagram*

Optimax can make low surface roughness optics from all of these materials.



* For reference use only

Transmission Bands of UV, Visible and IR Materials*

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