



aptiv®

VICTREX® PEEK FILM TECHNOLOGY

## APTIV® film technology for advanced design and high performance in acoustics and speaker applications.

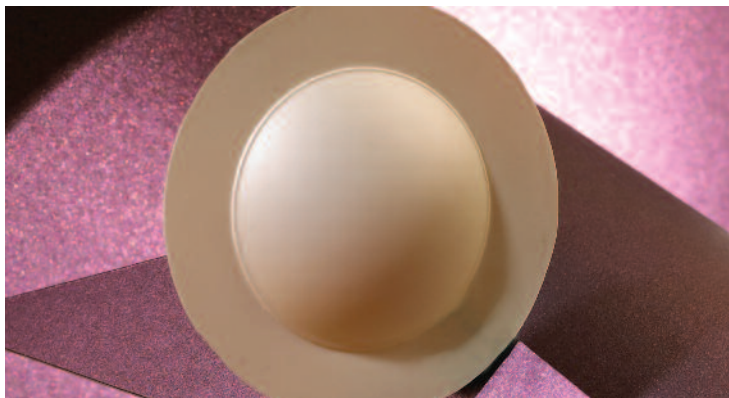
### A FLEXIBLE SOLUTION

The inherent acoustics, high temperature, mechanical, fatigue and processing attributes of Victrex APTIV film, produced from VICTREX® PEEK polymer, are well suited for use in acoustic film applications and present numerous opportunities for OEMs, designers and processors in the manufacture of leading edge, high performance speaker systems and acoustics related components.

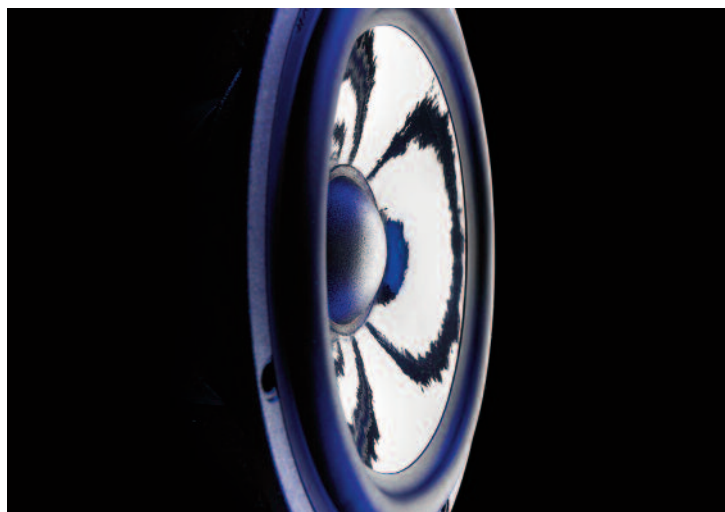
Especially suitable for use in loudspeaker applications, APTIV film has a unique combination of properties to facilitate meeting these challenges; high temperature performance, mechanical strength, chemical resistance, electrical insulation, fatigue resistance, and low moisture absorption, in a versatile film format.

### BENEFITS OF APTIV FILM FOR SPEAKER INDUSTRY

- Superior “tunable” acoustics
- Extreme temperature performance (>200°C)
- Excellent stiffness/weight ratio
- Outstanding mechanical properties
- Excellent fatigue and power handling capability
- Broad thickness range from 6 – 750 microns
- Easily thermoformed — to reduce systems cost



Compression driver diaphragm



Automotive speaker cone

### PERFORMANCE FOR SPEAKER APPLICATIONS

APTIV film outperforms the competition (PI, PEI, PPS, PAR and PEN) in mobile phone speakers when it comes to:

- Overall acoustic performance
- Total harmonic distortion (THD)
- Power handling
- High temperature stability
- Thermoforming (low temperature and short cycle times)

### THE APTIV FILM ADVANTAGE

- Tight Thickness Tolerances — extruding equipment has world-class process control.
- Wide Film Widths — up to 1.5 meters.
- Broad Thickness Range — from 6 to 750 microns.
- Plasma Surface Treatment — raises the film's surface energy to enhance adhesion, metallization, and printability.
- Process Flexibility — easy to thermoform
- Support — global technical, sales and marketing support.

Versatility, Performance and Acoustics for the Speaker Industry

# Versatility of Form

## APTIV® FILM KEY PROPERTIES

- High Heat Resistance
- Excellent Wear Resistance
- Low Moisture Absorption
- Purity
- Broad Chemical Resistance
- Environmentally Friendly
- High Strength and Toughness
- Electrical Stability
- Radiation Resistance
- Halogen Free\*, Low Smoke and Toxicity
- FDA Food Contact Compliant and Dairy 3A Certified
- Excellent Barrier Properties

\*According to the definition in IEC 61294-2-21, pure VICTREX PEEK polymer is classified as halogen-free.

## SECONDARY PROCESSES – FLEXIBLE SOLUTIONS

APTIV film can be subjected to a range of secondary processes to produce complex structures including:

- Adhesive systems
- Surface treatments
- Coatings
- Slitting
- Die cutting and stamping
- Thermal lamination
- Heat welding and heat sealing
- Thermoforming
- Laser marking, laser ablation and laser machining
- Printing
- Metallization



Cell phone speaker diaphragms

APTIV film is available in several grades according to the specific needs of the end use application. Within each grade a broad range of thicknesses are available from 6 to 750 microns. The standard width of APTIV film is 610 mm, although some films can be provided in widths up to 1500 mm. The stock rolls of film can be further slit down to widths of as low as 45 mm. Matte/Gloss and Gloss/Gloss surface finishes are standard. Other surface finishes are available upon request.

## 1000 SERIES

APTIV 1000 series films are unfilled semi-crystalline films. Available in thicknesses from 12 microns upwards, they are typically the mostly commonly used grade in the product range.

## 2000 SERIES

APTIV 2000 series films are unfilled amorphous films available in thicknesses from 6 microns up to 300 microns. The 2000 series of films are typically selected for processing to semi-crystalline nature using a thin gauge thermoforming process, and where either ductility or a level of optical clarity is required. If, in applications, or processing, temperatures above the glass transition temperature (T<sub>g</sub>) of VICTREX PEEK polymer [143°C (289°F)] are experienced, then the amorphous film will revert to the semi-crystalline form. This property is particularly advantageous when thermoforming parts from APTIV film.

## 1100 SERIES

APTIV 1100 series are mineral filled semi-crystalline films with the filler content being available at several loadings according to the application needs. The films are available in thicknesses from 12 microns upwards. The film is typically specified where either a higher modulus or lower coefficient of thermal expansion is required, than is offered by the 1000 series of APTIV film, in the application.

## 2100 SERIES

APTIV 2100 series are mineral filled amorphous films with the filler content being available at several loadings according to the application needs. The films are available in thicknesses from 12 microns upwards. The film is typically specified for processing to the semi-crystalline form using a thin gauge thermoforming process where either a higher modulus or lower coefficient of thermal expansion is required, than is offered by the 2000 series of APTIV film, in the application. If, in applications, or processing, temperatures above the glass transition temperature (T<sub>g</sub>) of VICTREX PEEK polymer [143°C (289°F)] are experienced, then the amorphous film will revert to the semi-crystalline form. This property is particularly advantageous when thermoforming parts from APTIV film.

# Applications

## TYPICAL SPEAKER AND ACOUSTIC APPLICATIONS

- Diaphragms
- Receivers
- Compression drivers
- Cell phone speakers
- Spiders
- Speaker cones
- Tweeters
- Ribbon speakers
- Condenser microphones
- Voice coil bobbins

## CELL PHONE SPEAKER DIAPHRAGMS

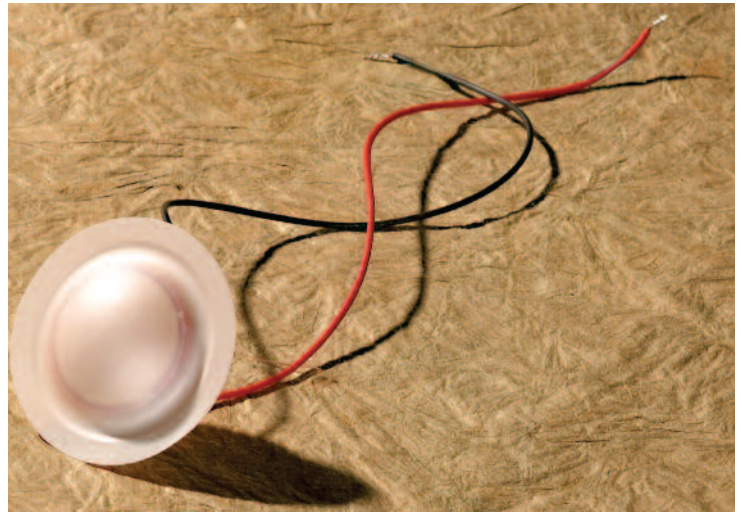
APTIV film has gained numerous specifications in demanding cell phone speaker diaphragms. These diaphragms must be able to manage extremely high power inputs and high temperatures while producing excellent sound quality in a very small package. APTIV film has the ability to survive temperatures in excess of 230°C (446°F) combined with outstanding fatigue properties, and yet it is easily thermoformable with short cycle times on standard equipment.

## COMPRESSION DRIVERS

APTIV film is lighter than titanium or aluminum and therefore more responsive than metal compression driver diaphragms. APTIV film provides better fatigue performance, lower Total Harmonic Distortion, and a perceived better sound quality. Furthermore, APTIV film's mechanical properties can be further enhanced with a variety of fillers that can provide additional stiffness and internal dampening.

## TWEETER DIAPHRAGMS

A filled grade of APTIV film was selected by Cabasse, a French manufacturer and pioneer of high efficiency loudspeakers, for use in a tweeter diaphragm of its La Sphere speaker system. The APTIV film provided a very rigid, lightweight and well damped tweeter diaphragm with perfect linearity of the response curve up to 25,000 Hz, along with excellent power handling and reliability over time. La Sphere is an audio speaker system that is the result of an ambitious 13 year project to create a true 4-way co-axial point source with no mechanical compromise, driven by specific digital signal processing. The acoustic properties of APTIV film combined with its versatility enabled Cabasse to improve its design and set a new standard in loudspeaker performance.



Speaker tweeter membrane

To reach the ideal acoustical solution it was first necessary to design and validate the TC23, a 3-way co-axial driver in which Cabasse's engineers used all their knowledge and expertise in high-end acoustic technologies. This 3rd generation of 8" co-axial 3-way units is then fitted with a brand new tweeter including an exclusive thermoformed diaphragm that uses high performance APTIV film to create the new 4-way speaker system. Computerized machines carry out the production of these diaphragms, so that the process is automated and meticulous, preventing any alteration of the characteristics of the material involved and ensuring accurate parameters for every item produced.

APTIV film was selected as the diaphragm material for its excellent rigidity/weight ratio and the perfect mechanical homogeneity with the ring diaphragm of the midrange unit. Fitted with a foam diaphragm, the low-midrange transducer has been redesigned with an extended stroke and reinforced power handling, to obtain excellent acoustic reproduction qualities, without compromising on the linearity, efficiency and power handling parameters of each component of the system.



Speaker spider

www.aptivfilms.com



Victrex Polymer Solutions, a division of Victrex plc, is the world's leading manufacturer of Polyaryletherketones, high performance polymers, which are sold under the brand names VICTREX® PEEK polymer, VICOTE® Coatings, APTIV® films and VICTREX Pipes™. With production facilities in the UK backed by sales and distribution centres serving more than 30 countries worldwide, our global market development, sales, and technical support services work hand-in-hand with OEMs, designers and processors offering assistance in the areas of processing, design and application development to help them achieve new levels of cost savings, quality, and performance.

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