PyroCarbon Implants
Durability + Biocompatibility
What is PyroCarbon?

PyroCarbon is a specific form of carbon that has been tailored for durability and compatibility. PyroCarbon has portions of 2-D and 3-D crystalline structures, resulting in excellent strength and wear properties between those of graphite and diamond. *PyroCarbon should not be confused with carbon fibers,* which are minute particles used to strengthen other materials.

Manufacturing a PyroCarbon implant begins with a precision-machined graphite substrate that contains 1 atomic percent tungsten to make the core visible on X-ray. Using patented steady-state process controls, a thick layer of radiolucent On-X® pure carbon is deposited onto the graphite core, maximizing strength and durability.
Because of its proven clinical durability and unique biocompatibility, PyroCarbon has shown to be an excellent material for orthopedic applications.

**Patented On-X® PyroCarbon demonstrates:**

- Excellent wear characteristics
- Superior compatibility with joint cartilage and bone
- A modulus of elasticity similar to bone minimizing stress shielding effects and resorption
- Non-cemented fixation by direct bone apposition


Ascension Orthopedics is the world leader in PyroCarbon orthopedic implants, with 30 years of PyroCarbon clinical experience and over 30,000 PyroCarbon joints implanted.*

**Biocompatibility**
PyroCarbon is Durable

The long-term clinical experience with PyroCarbon *exceeds 40 years* as heart valve prostheses and *30 years as orthopedic implants*.

**Near Natural Wear Characteristics**

Native joints have been shown to lubricate through the adsorption of surfactant (surface-active phospholipid) to cartilage which provides boundary layer lubrication. Similarly, adsorption of surfactant and other biological molecules on the surface of PyroCarbon offers a boundary layer lubrication mechanism for the favorable wear characteristics of PyroCarbon against both itself, in total joint replacement, and against native cartilage or bone in hemiarthroplasty.²,³,⁴

This graph depicts the wear characteristics of a PyroCarbon ball and socket implant compared to CoCr/UHMWPE ball and socket implant. All test specimens were subjected to a 14 lb. axial load and taken through 90° ROM for 10,000,000 cycles.

PyroCarbon is highly wear resistant and durable. This is ideal for orthopedic implants because it virtually *eliminates wear-related failures* as historically seen with implants made of metal and polymers.

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2. Hills BA, Oligolamellar lubrication of joints by surface active phospholipid, J. Rheumatol 1989; 16:82-91
PyroCarbon is Bone Friendly

The elastic modulus of PyroCarbon is very similar to cortical bone resulting in biomechanical compatibility with bone. Unlike surgical grade metals, PyroCarbon transfers load from implant to bone more effectively, thus reducing stress shielding and potential bone resorption.5

Elastic Modulus (GPa)

- Cortical Bone: 23
- PyroCarbon: 29.4
- Titanium: 105
- Zirconia: 210
- CoCr Alloy: 230

PyroCarbon exhibits exceptional wear performance against bone compared to ceramic and metals. After cyclical testing to 5,000,000 cycles, PyroCarbon demonstrated minimal wear into cortical bone. It was not possible to test the other materials past 375,000 cycles with Cobalt Chrome, 50,000 cycles with Titanium and 25,000 cycles with Zirconia because the bone specimens had worn away.6


PyroCarbon is Cartilage Friendly

PyroCarbon has been shown to be much less damaging to native cartilage and bone joint tissues than metal alloys. PyroCarbon's low surface friction and nonadhesive properties may contribute to preserving cartilage. PyroCarbon offers the ability to extend the functional life of these joints and thus transform extremity hemiarthroplasty.

Cartilage Survival

A study of cartilage wear in 45 canine acetabula was performed using both PyroCarbon and metal alloy hip prostheses. PyroCarbon showed remarkably less wear damage to cartilage. After 18 months, cartilage articulating with PyroCarbon exhibited a 92% survivorship probability compared to a 20% cartilage survivorship with metallic alloys.\(^7\)

Clinical Observation

Native cartilage after contact with PyroCarbon for 23 months appears healthy and undamaged.\(^8\)


Ascension Orthopedics continues to research and develop new applications of PyroCarbon technology for extremity surgery. Decades of biomedical research and clinical outcomes demonstrate that PyroCarbon is a durable and biocompatible material — revolutionizing modern arthroplasty.

**Durability + Biocompatibility**

**Fixation of PyroCarbon**

Pyrocarbon has a micro-porous structure that enhances bone fixation without the need for cement. This unique fixation is achieved initially through a press fit design using precise instrumentation. Long term fixation is achieved via appositional bone growth as bone remodels up to the biologically active surface of PyroCarbon.⁹

To learn more about Ascension Orthopedics PyroCarbon implants, please contact us. To find out how you can begin using PyroCarbon implants today, visit us online at www.ascensionortho.com/PYC.