



# Symposium: Advances in PEEK Technology

## Editorial Comment: Advances in PEEK Technology

Steven M. Kurtz PhD

**P**olyetheretherketone (PEEK) is an established implantable orthopaedic biomaterial used spinal surgery, mainly in the form of intervertebral cages. In recent years, there has been a growing interest in improving the affinity of PEEK for bone ongrowth and ingrowth applications. In addition, there has been interest in exploring the potential suitability of PEEK as an orthopaedic-bearing material. Early studies with

PEEK bearings examined the possibility of replacing ultra-high molecular weight polyethylene (UHMWPE), but the long-term clinical success of highly crosslinked UHMWPE (HXLPE) diminished practical interest in such applications. Orthopaedic bearings incorporating contemporary ceramic and HXLPE biomaterials are no longer perceived to be clinically limited by their wear characteristics; in large measure for that reason, advances in implant technology must necessarily consider overall economic value alongside clinical efficacy. Because of this new focus, orthopaedists view PEEK biomaterials principally as a potential replacement for metal components, such as the femoral component in total knee replacement. Orthopaedists also view PEEK biomaterials as a potential replacement for metal fracture fixation systems, such as in proximal humerus and distal radius plates and tibial nails.

Innovation in PEEK biomaterials continues at a steady pace, and I am excited to share some of the best work



Steven M. Kurtz PhD

I have seen on this topic here in this symposium on advances in PEEK technology. This symposium derives from selected papers from the 2nd International PEEK Meeting, which took place in Washington, DC, from April 23–24, 2015. The meeting gathers together engineers, scientists, regulators, and physicians with connections to academics, industry, and government agencies in order to present innovative research on developments in medical-grade PEEK technology. Readers can view the archived abstract proceedings for all of

---

The institution of SMK has received, during the study period, funding from Invibio Inc (Conshohocken, PA); Smith & Nephew (Andover, MA); Stryker (Kalamazoo, MI); Zimmer Biomet (Warsaw, IN); Depuy Synthes (West Chester, PA); Medtronic (Langhorne, PA); Stelkast (McMurray, PA); Formae (Paoli, PA); Kyocera Medical (Osaka, Japan); Wright Medical Technology (Memphis, TN); Ceramtec (Laurens, SC); DJO (Vista, CA); Celanese (Irving, TX); Aesculap (Central Valley, PA); Simplify Medical (Mountain View, CA); Active Implants (Memphis, TN); and Ferring Pharmaceuticals (Parsippany, NJ) outside the submitted work.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research*® editors and board members are on file with the publication and can be viewed on request.

The opinions expressed are those of the writers, and do not reflect the opinion or policy of *CORR*® or The Association of Bone and Joint Surgeons®.

---

S. M. Kurtz PhD (✉)  
Exponent Inc, 3440 Market St., Suite  
600, Philadelphia, PA, USA  
e-mail: skurtz@exponent.com

# Symposium: Advances in PEEK Technology

the presentations at this conference by visiting <http://www.medicalpeek.org>.

Although spine surgeons have some experience with PEEK biomaterials, implants made from these materials are closer to the beginning of their clinical journey in joint replacement and trauma. Part of what attracted spine surgeons to PEEK as an alternative to metal was its radiolucency, compatibility with MRI imaging, and, compared with metal components, the reduced likelihood of stress shielding. PEEK does not corrode, nor does PEEK liberate metal ions.

In fairness, we do not yet know whether these hypothesized benefits will improve clinical outcomes of orthopaedic and trauma-surgery patients in the future. What is certain, however, is that advances in PEEK implant technology will require rigorous preclinical and clinical research studies to establish their efficacy and safety profiles. In a post-metal-on-metal era, there is heightened sensitivity to the rigorousness of preclinical

evaluation in orthopaedic surgery. We are also more thoughtful and measured in our clinical introductions of new technologies as we gather a better understanding of the benefit versus risk ratio for these novel devices.

We encourage the clinicians who are readers of *CORR*<sup>®</sup> to familiarize themselves with PEEK, including its strengths and limitations, as a potential candidate biomaterial for orthopaedic and trauma surgery. One particularly exciting application for PEEK is as a potential replacement for CoCr femoral components in total knee arthroplasty. As described in this symposium, a PEEK femoral component may reduce stress shielding around the implant and provide a metal free solution to clinicians concerned about metal allergy. Readers will also find wear studies of PEEK articulating against HXLPE and traditional biomaterials, as well as a systematic review of wear particle studies related to PEEK. In addition to the articles in this symposium, readers may wish to consult review articles

[1–3] and an educational website ([www.medicalpeek.org](http://www.medicalpeek.org)) related to the clinical history of PEEK biomaterials. We have already performed a great deal of basic science and preclinical research to develop PEEK technology for orthopaedics and trauma. We are at the forefront of many unanswered clinical questions regarding PEEK technology, and there is much to learn.

## References

1. Kurtz SM, Devine JN. PEEK biomaterials in trauma, orthopedic, and spinal implants. *Biomaterials*. 2007;28:4845–4869.
2. Li CS, Vannabouathong C, Sprague S, Bhandari M. The use of carbon-fiber-reinforced (CFR) PEEK material in orthopedic implants: A systematic review. *Clin Med Insights Arthritis Musculoskelet Disord*. 2015;8:33–45.
3. Panayotov IV, Orti V, Cuisinier F, Yachouh J. Polyetheretherketone (PEEK) for medical applications. *J Mater Sci Mater Med*. 2016;27:118.