



## **WORKSHOP ON ADDITIVE MANUFACTURING FOR MEDICAL APPLICATIONS**

Sponsored by ASTM Committee F04 on Medical and Surgical Materials and Devices

May 3, 2016  
Grand Hyatt San Antonio  
San Antonio, TX

Workshop Chairs: Terry Woods  
U. S. Food and Drug Administration  
Silver Spring, Maryland, USA

Rod McMillan  
DePuy Synthes Trauma  
West Chester, Pennsylvania, USA

Jon Moseley  
Wright Medical  
Memphis, Tennessee, USA

**TUESDAY, MAY 3rd, 2016**

12:00 PM  
**Opening Remarks**

### **Session 1: Design, Manufacturing, and Cleaning of AM Components**

Session Chair: Rod McMillan

12:10 PM  
**Design for Manufacturability in Metals Additive Manufacturing**  
F. Medina, S. Levesque, D. Robinson, and A. Haines, Buffalo Manufacturing Works, Buffalo, NY, USA

12:25 PM  
**Early Examples with Additive Manufacturing Models for Planning of Complex Joint Replacement Surgery**  
H. Haider and K. Garvin, University of Nebraska, Omaha, Nebraska, USA

12:40 PM

**Results of Studies of Ultrasonic Parameters – Potential Impact for Cleaning of Additive Manufactured Medical Devices**

E. Kanegsberg and B. Kanegsberg, BFK Solutions, Pacific Palisades, CA, USA

12:55 PM

**Measuring Patient-Matched Cutting Guide Design Variability in Total Knee Arthroplasty**

J. Coburn, U. S. Food and Drug Administration, Silver Spring, Maryland, USA

1:10 PM

**Standards Review for Cleaning and Sterilization of Additive Manufactured Metal Medical Devices**

E. Kanegsberg and B. Kanegsberg, BFK Solutions, Pacific Palisades, CA, USA

**Session 2: Materials Qualification and Characterization**

Session Chair: Jon Moseley

1:25 PM

**Opening Remarks**

1:30 PM

**Metal Additive Manufacturing: Overview of Materials Qualification**

M. Seifi and J. Lewandowski, Case Western Reserve University, Cleveland, Ohio, USA

1:45 PM

**Powder quality and characterization critical to high performance functional components in Additive Manufacturing**

J. Hunter, LPW Technology, Runcorn, Cheshire, UK

2:00 PM

**Challenges in Measurement and Specification of Complex Additive Manufactured Structures for the Medical Device Industry**

P. Shah, R. Racasan and P. Bills, University of Huddersfield, Huddersfield, West Yorkshire, UK

2:15 PM

**Areal Surface Texture Measurement of Additively Manufactured Parts**

A. Townsend, L. Pagani, C. Yin, P. Bills and L. Blunt, University of Huddersfield, Huddersfield, West Yorkshire, UK

2:30 PM

**Surface Finishing of Titanium Parts for the Biomedical Industry**

A. Diaz, L. Winkelmann and J. Michaud, REM Surface Engineering, Southington, Connecticut, USA

2:45 PM      BREAK

### **Session 3: Mechanical Characterization and Testing**

Session Chair: Terry Woods

3:05 PM

#### **Opening Remarks**

3:10 PM

#### **Effect of Build Orientation on Axial/Torsional Fatigue Life of Laser Sintered Ti-6Al-4V ELI**

M. Di Prima, U. S. Food and Drug Administration, Silver Spring, Maryland, USA

3:25 PM

#### **Evaluation of the Performance Effects of Machining versus Additive Manufacturing Processes on Medical Implant-Grade Titanium**

V. Trafka, D. Buchanan and D. Lissy, Empirical Testing Corp., Colorado Springs, Colorado, USA

3:40 PM

#### **Fatigue Properties of a Titanium Alloy (Ti-6Al-4V) Fabricated Via Electron Beam Melting (EBM): Effects of Internal Defects and Residual Stress**

N. Hrabe, National Institute of Standards and Technology, Gaithersburg, Maryland, USA

3:55 PM

#### **Development of a Selective Laser Sintered (SLS) Titanium Foam for Orthopedic Applications**

D. Scholvin, D. Linton, J. Fleming and J. Moseley, Wright Medical, Memphis, Tennessee, USA

4:10 PM

#### **Polymeric Additive Manufacturing for Applications in Orthopaedics: How Testing Standards are of Benefit**

T. Gascoyne<sup>1</sup>, L. Rodgers<sup>2</sup>, J. Orrock<sup>2</sup>, M. Petrak<sup>1</sup>, 1) Ortho Innovation Center, Winnepeg, Manitoba, CA, and 2) Stratasys Inc., Eden Prairie, Minnesota, USA

### **Session 4: Standards for Additive Manufacturing**

4:25 PM

#### **ASTM Standards for Additive Manufacturing: F42 and F04**

Rod McMillan, DePuy Synthes Trauma, West Chester, Pennsylvania, USA

4:40 PM

#### **Panel Discussion: Standards Impact on the Regulatory Experience**

M. Di Prima, J. Coburn, D. Scholvin, V. Trafka, F. Medina, J. Hunter and A. Diaz

Moderator: Jon Moseley

5:15 PM

**Panel Discussion: New Standards Needs**

H. Haider, N. Hrabec, T. Gascoyne, A. Townsend, P. Shah, M. Seifi, and B. Kanegsberg

Moderator: Terry Woods

5:50 PM

**Closing Remarks**

6:00 PM

**WORKSHOP ADJOURNS**