



**Pune  
Chapter**

***ASM International Pune Chapter***

Cordially invite you  
for  
Technical Presentation  
on

**“Advancements in Shot Peening Technology –  
No Longer an Afterthought for Product Design”  
by**

**Mr. Steven E. Ferdon**

Global Director  
CFS Engineering Technology

On Wed 14<sup>th</sup> Oct 2015, 7.00 pm

,  
Hotel Tarawade Clarks Inn,  
1205/2/5, Shirole Road Office, JM Road,  
Shivajinagar, Pune, 411005  
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***Join us for Networking Dinner thereafter***

**Rahul Gupta**  
Secretary

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## ABSTRACT

Shot peening is an old, tried and true process, that is most typically used as a countermeasure to fatigue failure, when all other design & material processing avenues are found closed. Most materials engineers understand it to be a line of sight process, with use limited to external surfaces. Further, there is a common perception that all the research that could be done has been done and that serious technical study was concluded back in the 70's. However, nothing could be further from the truth and new advancements in this surface engineering technology gives material & process designers more options than ever before.

# Steven E. Ferdon

## Professional Accomplishments

Global Director of Engineering Technology, Cummins Fuel Systems  
World Wide Functional Excellence Leader – Materials Science & Technology, Cummins Inc.  
Metal Processing Institute Center for Heat Treat Excellence – Board Chair (2014-today)  
AISI Bar Steel Fatigue Property Consortium Steering Committee (2002-Today)  
Advisory Committee Purdue School of Materials Engineering (1999 –Today)  
Outstanding Materials Science Engineer – Purdue School of Materials Engineering - 1998  
ASM International (Materials Engineering Professional Society) 1979 - Present  
Licensed Professional Engineer – Indiana

## Professional Experience

### **Cummins Engine Co., Fuel Systems Business,** Columbus, IN

#### **Global Director – CFS Engineering Technology? June 2012 – Present**

Joined “Global Engineering Staff”, expanding Engineering Services to a global matrix organization with employees in Juarez Mexico, Wuhan China, Pune India & Sodertalje Sweden  
Manage Analysis Led Design, Applied Mechanics, Thermal Fluids Science, Material Sciences, Engineering Functional Excellence, Engineering Standard Work and Safety, Integrated Process Excellence

#### **Chief Engineer – CFS Engineering Services ? 2007– 2012**

Combined Materials Science Engineering with Applied Mechanics, Configuration Management / Drafting, Thermal Fluid Science & Lab Operations  
Added process engineering responsibility for CFS Heat Treat Shop as well as global Cleaning/Millipore operations

#### **Chief Engineer – Materials Science Engineering ? 2004 - 2007**

#### **Assistant Chief Engineer – Materials Science Engineering ? 2002 – 2004**

Managed a group, which grew from 3 to 8 engineers, supporting all legacy & development fuel system products, with all aspects of materials engineering services and analysis  
Added CFS Heat Treat Shop as well as Cleaning/Millipore Process engineering to department's responsibility  
Started Materials Engineering function in Juarez and Wuhan

#### **Technical Advisor – Materials Science Engineering ? 1997 - 2002**

#### **Technical Specialist – Materials Science Engineering ? 1992 - 1997**

Responsible for material and material processing selection and specification through entire product life phase ... PPT to Re-Manufacturing ... for HPI, CAPS & CCR  
Work included, failure analysis of components & manufacturing processes, specification writing, supplier support, material process development & validation & material property characterization

## **WILLIAMS INTERNATIONAL**

Walled Lake, MI

#### **Group Leader, Materials & Process Engineering? 1988 - 1992**

Led team of five Materials Engineers, supporting design and development of non-man rated gas turbine engines for defense applications.

## **Failure Analyst, Materials & Process Engineering ?1985 - 1988**

Conducted forensic analysis and investigations to determine root cause and corrective actions for component structural failures in aerospace and land based gas turbine engines for defense applications.

## **DUKE POWER CO**

Charlotte, NC

## **Metallurgist – Mechanical Nuclear Engineering – 1982 – 1985**

Responsible for welding technology, corrosion engineering, material specifications & failures analysis, in support of design & construction n of four nuclear power stations

## **Patents**

2009/0267,008 - Solenoid Flow Control ValveStator Core, Plated with Non-Ferrous Material

7,278,400 - Juncture for a High Pressure Fuel System

5,829,411 - Wear Resistant Distributor Rotor

5,713,333 - Wear Resistant Distributor Rotor

## **Education**

BS Materials Science Engineering–Purdue University, W.Lafayette, IN ?1982

## **Life Outside of Work .....**

Managing Director - Mission Columbus Housing Rehabilitation Ministry

Indiana SE District - Disaster Response Coordinator – UMCOR

Church Youth Group Leader – Asbury United Methodist

Housing Partnerships Inc., Board of Directors 2006-2011

Golf, Skiing, Hunting&Carpentry

Boy Scout Leader (retired)

Coach - Football, Baseball, Basketball, Soccer (retired)

## **Accomplishments – Chief Engineer, Materials Science**

Original contributor or lead/coached the implementation of the following solutions & innovations...

### **XPI – 2014 / China-India FFM Common Rail**

**Assembled Camshaft >** Cost reduction, induction thermal assembly replacing near net forging

**“Black Box” Mat’l & Workmanship Spec >** CES 10093, for purchased assemblies & products

**Cam Rig >**Component level testing of HP pump cam/tappet trains

**CFSW Met/Chem Lab >** Forward deployed lab for fast customer / supplier issue response

**Carbo-Nitride Armature >** Cost reduction, Case hardened C-Steel replacing Si-Fe & Tribology

**DLC / 52100 Pumping Plungers >** Reduced fuel/oil transfer over zirconia

**DLC / 52100 Tappet Pins >** Acidic oil corrosion resistance

**Nozzle Failure Atlas >** Catalog of common nozzle failures and corrective actions

**Pump Head Failure Atlas >** Catalog of common pump head failures & corrective actions

**Sick Nitride Furnance Test >** Detection of fatigue reducing epsilon nitride white layer

**Solvent Free Particle Counting >**Neutracare 5088, eliminate skin irritation of Envirosolve

### **XPI – 2007/2010**

**17-22AS/Ovako 225 Pump Hds>** More robust nitride case, greater residual compressive stress

**AISI Bar Fatigue Group Database>** Strain based fatigue properties for alloy bar steels

**AFM Pump Head>** Drilling ID polish, intersection burr removal

**Calo Testing >** Lab gage for checking DLC coating thickness

**Controlled & Restricted Substance Spec.>** Cummins Black/Gray/Yellow list

**CT Scan X-Ray>** Non-destructive evaluation of cavitation erosion in nozzle spray holes.

**Eddy Current Nozzle HT Inspection >** High volume, rapid quality inspection

**FSQ Steel Specifications**>Corporate standard for high performance “clean” steel  
**H-13 Nitrided Pilot Valve Seat**> Abrasive particle erosion resistance & fueling creep resistance  
**Heat Treater Validation Guide** > Source approval criteria for critical heat treating processes  
**Induction tempering 52100 barrel threads**> Thread cracking elimination, increased ductility  
**Induction Hardened Actuator Hsg. Bore**> Cost & distortion reduction  
**Lance Peened Injector Body ID**> Improved fatigue life with residual compressive stress  
**M2 Spring Retainer**> Beat-in wear & fatigue cracking solution  
**M-50 Tool Steel Spring Disks**> High temp bearing material solution to creep yield failure  
**Magnetic Property Testing Lab**>Enabled ALD design of actuators & solenoids  
**Mfg. & Workmanship Spec.** > Replaces CES 16061, closes many basic requirement gaps  
**MIM Armature**> Cost reduction  
**Pb Free Solder Specification** > Process & under-plating to solve bond length problems  
**Pb Free Cam Journal Bearing**> Daido ... Bearing Alloy A66T ... Backing Alloy DS05  
**P/M Oxidized Powder Stator** >Maximize armature pulling force w/minimum eddy current loss  
**PVD Coating Validation Guide** >Source approval roadmap for suppliers of PVD Coatings  
**“Q Grade 52100”**>Ovako “special bearing quality” steel for pump barrel fatigue failures  
**Steelmaker Validation Guide** > Source approval criteria for suppliers of FSQ Steel  
**Traceability & Marking Spec.**> Systematic, flexible and invokes industry standard practices.

## CCR

**Digital Imaging System** > Rapid capture and delivery of image data  
**DLC Coated Check Valve Plungers:** Reduced friction to solve recurring “stiction” problem  
**Induction Hardened Guide Pin Slot** > Low cost solution to guide pin wear  
**Met/Chem Lab Request Database** > Fast, world wide portal, easy report & data retrieval  
**Tapered Bearing Spec.** >Benchmark for “black box” component specifications

## CAPS-I

**A-2 Tool Steel Control Valve Plungers** > Avoidance of heat treat distortion.  
**Allegheny Ludlum Relay 5, Armature** >Lower cost material &eliminated heat treat  
**Bronze (Mg-Si) Tappet Roller Pin** > Tappet roller scuffing and abrasive wear  
**Cleanliness Standard, CES 16599** >Current corporate standard for component cleanliness.  
**Document Database “Superman”**>Faster, easier & retrievable technical reports and memos  
**Fluorocarbon Elastomer Specifications** >Incomprehensible anarchy in prior specification  
**CFS Heat Treat Specifications**>Industry leading practice, 12 specifications replaced over 40  
**Retained Austenite Standard** > Supplier conflicts due to variation in operator interpretation  
**Stainless Seal Washers** > Cost reduction over the old very hard, very flat design practice  
**Titanium Nitride Coated Distributor Rotor**> Abrasive wear and thermal seizure failures  
**Vacuum Hardening Accumulator Brick** >System cleanliness & partial carburization failures  
**Zirconia Ceramic Pumping Plungers** > Plunger scuffing ... Program was stuck in development

## HPI – HD & HHP

**Aermet-100 Spill Rings**> Fatigue cracking that defied all logic  
**Austempered, Fine Blanked Valve Guide** > Cost reduction  
**Barkhausen Noise – Grinder Burn**>Non-Destructive alternative to macro etching  
**Cavitation Damage Scale** > Tool for evaluating effectiveness of design changes  
**Diamond Like Carbon (DLC) PA-CVD Coating**> Replace Ti-Nitride for '07 HD side load wear  
**Fine Blanked Si-Fe Armature** > Cost reduction  
**Material Property Database** >Global MSFE Tool for ALD material properties  
**Multi-Channel Eddy Current** > 100% Screening & daily audit of injector barrel heat treatment  
**Nitrided H-13 Nozzles** >Solution to high temperature fatigue failures of 8620 carburized  
**Particle Count Cleanliness Inspection**> Per Scania requirement, improved repeatability  
**S-7 Tool Steel Spring Retainers** > Impact fatigue failures as plunger whacked into barrel  
**Titanium Nitride Coated Injector Plungers**> Scuffing and seizure failures  
**Vacuum Carburized Nozzles**> Intergranular oxidation fatigue failures  
**VIM-VAR Quality Steel Nozzles (HHP only)**>Solution to Inclusion initiated failures.  
**X-Ray Diffractometer** > Real time quality control audits for retained austenite& residual stress