HPC4Mfg Program Webinar

Advancing Innovation: National labs partner with US Manufacturers to increase innovation and energy efficiency

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Lawrence Livermore National Laboratory

BERKELEY LAB

OAK RIDGE National Laboratory

HPC4Mfg
ADVANCING INNOVATION

Today's Agenda

2:00 – 2:05 EDT Welcome and webinar instructions

2:05 – 2:20 EDT Overview of program

2:20 – 3:00 EDT Q&A

Participant instructions

- Please turn off video and mute your phone when not asking a question

- Questions will be answered at the end of the briefing
  - Send to "Everyone" via Chat

HPC can help infuse innovation into US Manufacturing to bring advanced products to market and save on energy

Apply High Performance Computing (HPC) capabilities and expertise at the national labs to increase US Manufacturing innovation and energy efficiency

De-risk the adoption of HPC into the US Manufacturing Industry

Benefits of HPC to US Industry

- Accelerate innovation

- Optimize design

- Reduce testing cycles

- Shorten the time to market

- Quality processes and Pre-qualify

- Reduce waste/reduce rejected parts

- Lower energy costs

HPC4Mfg enables partnership between the National Labs and US Manufacturing

Increase Energy Efficiency - Advance Clean Energy Technologies

US Manufacturers and/or supporting organizations submit concept papers
- Identify industry challenge with big impact
- Up to 1 year duration
- Commit 20% "in kind" funding (non-gov)
- IP Protection through CRADA
- Announce success

AMO funds National Labs to partner with US Manufacturers

Project execution

Full Proposal   Late Oct

Mid July

Concept Papers

4/21/16

Solicitation Announced

3/17/16

National labs
- LLNL (lead), LBNL, ORNL, other labs join in future calls
- Provide HPC capabilities and mod / sim expertise
- PI will be selected by labs to develop full proposal
- < $300k DOE funding per project; ~ 10 projects
- DOE Model Short Form CRADA

US Manufacturing losing market share and large energy consumer

A limited number of Phase II projects may be considered

Program Details: Eligibility and Funding

- Eligibility for call
  - Companies manufacturing in the US
  - Manufacturing-supporting organization
  - US Universities with strong tie to industry

- Who can be funded from the program
  - LLNL, LBNL, ORNL
  - In limited amounts, US Universities

- Industry participant cost share
  - At least 20% of project funding
  - Can be used to support internal staff
  - Source can not be other federal funding
  - Waiver available for qualified universities

Program Details: DOE Model Short Form CRADA

- Used for accelerated placement and execution

- Scope and IP protection defined

- Awardees expected to sign DOE Model Short Form CRADA

- Objections to terms and conditions can be stated in concept paper, however this could lead to delays and rejection of proposal

Program Details: What types of projects are acceptable

- Broad impact on energy efficiency. These can include
  - existing process optimization
  - advanced product design
  - predicting performance and failure rates

- Accelerating adoption of clean energy technologies. These can include new design and discovery on products or processes that impact energy use. Examples include new materials that
  — lower carbon release into atmosphere during use
  — lower energy during manufacturing.

Program Details: Selection criteria

- Degree to which the proposed effort advances the current "State of the Art"

- Appropriateness for national laboratories

- Technical feasibility

- Industry participant contribution and participation

- Impact, including Lifecycle Energy Impact, broad industrial impact through new clean energy technology development and/or energy efficient manufacturing technologies, as well as impact on employment and manufacturing in the United States

- Strength and balance of the technical team, including modeling expertise on both the national laboratory and industry sides and process experts for the model validation

Reducing energy in paper-making could save 80 trillion BTUs per year

- **Industry partner: Agenda 2020, paper-manufacturing consortium**

- **Rewetting of paper pulp following pressing-is widely considered to be a leading contributor to the energy intensity in paper making (3rd largest).**

- **LLNL and LBNL researchers are developing coupled-physics simulations to determine how water flows through porous paper pulp during and after the pressing process. The 2 approaches are continuum and pore-based models.**

- **New press designs could reduce energy consumption by up to 20% (80 trillion BTU, in $240M - $400M annually).**

http://www.rvii.com

Paper

Rewet

Felt

Roll press-dry

(Agenda 2020)
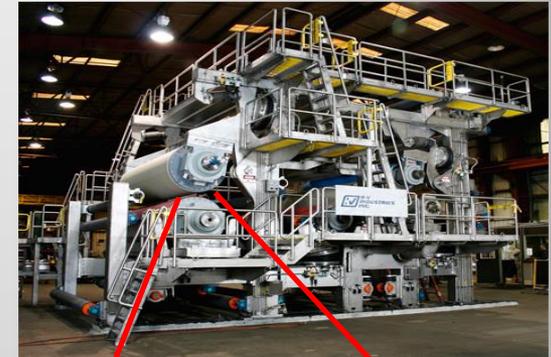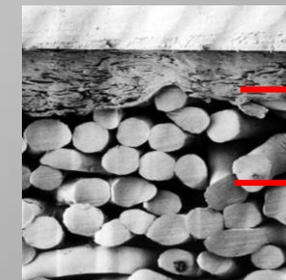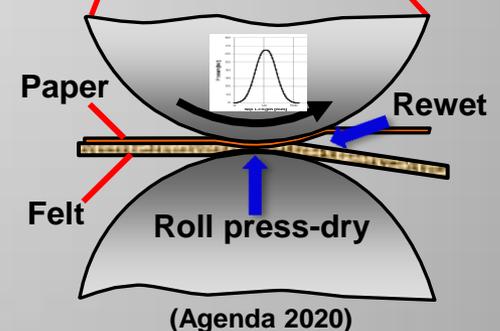
Paper

Felt

Initial modeling results show deformation and dryness of paper as it traverses rollers in continuum model

zoomed in mesh (deformed)
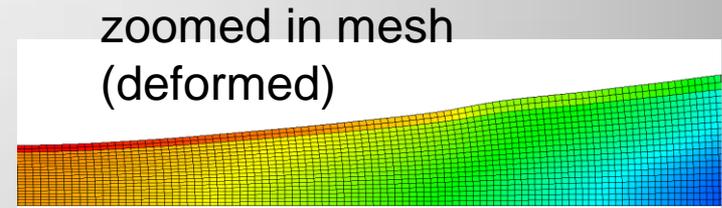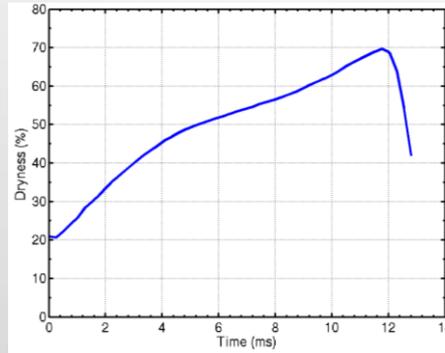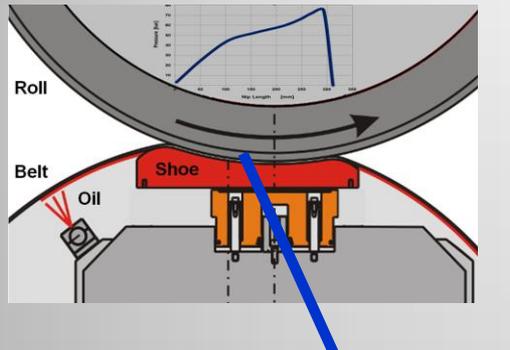
deformed paper/felt in the press nip

paper

felt

312 mm

Pseudocolor
Var: dryness

0.3004   0.4163   0.5322   0.6481   0.7640
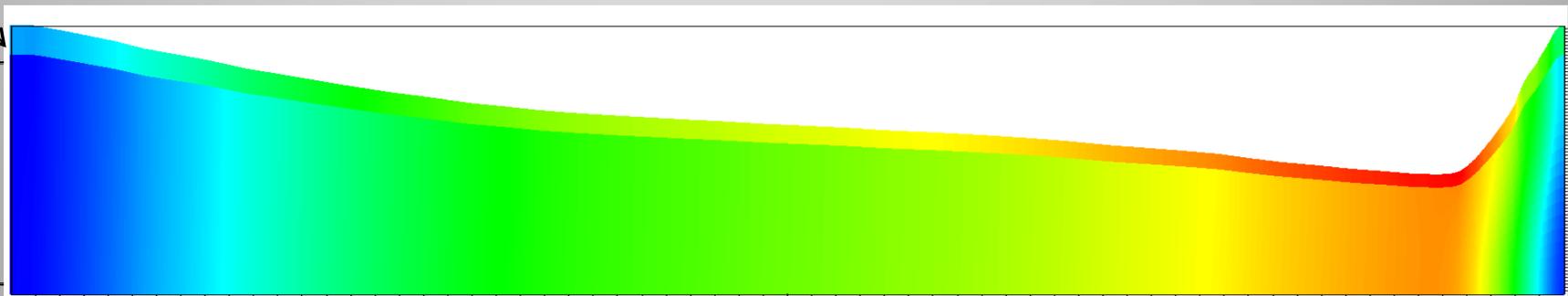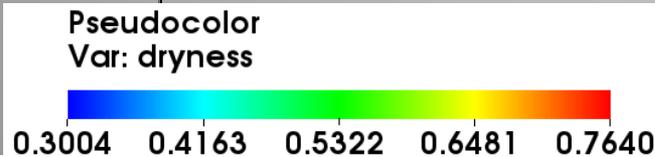
Models of deformation and dryness of compressed paper/felt can be used to optimize drying

# Reducing coke usage in steel-making could save $900 million per year

- **Industry partner: Purdue Calumet (steel-manufacturing consortium)**

- **Carbon – rich natural gas and coke are used in large quantities in steel production. Molten iron production optimization will reduce carbon loads to the environment and process costs.**

- **LLNL researchers improve blast furnace models and run a series of simulations of complex reactive flows through particles of coke and iron ore. These simulations identify furnace conditions with reduced coke utilization.**

- **Optimized blast furnace processes could save $900 million/year industry-wide by reducing coke consumption.**

1000X improvement in computational speed, parametric studies to reduce coke consumption
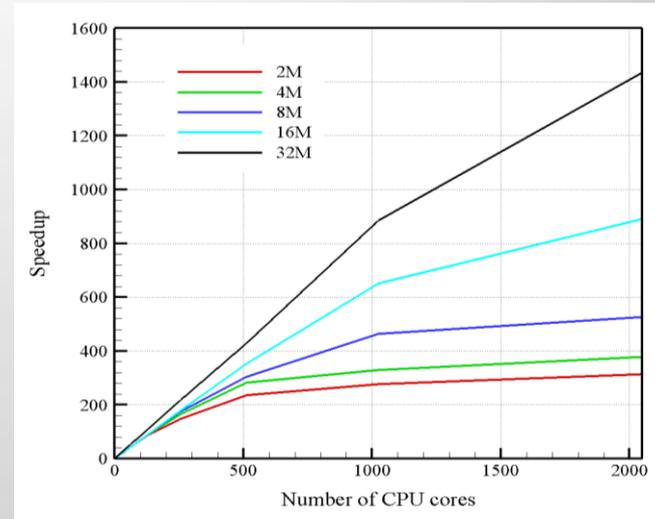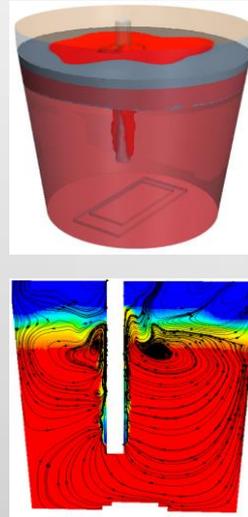
StarCCM models decrease computational time 1000X for ladle mixing showing pure molten steel on bottom and slag on top
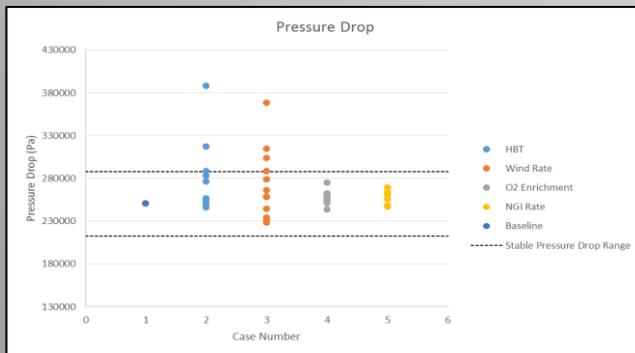
Parametric studies of blast furnace will help reduce coke usage especially in partial-capacity production runs

Scaling up a new GaN process could yield 20% cheaper LED lighting and new power electronics
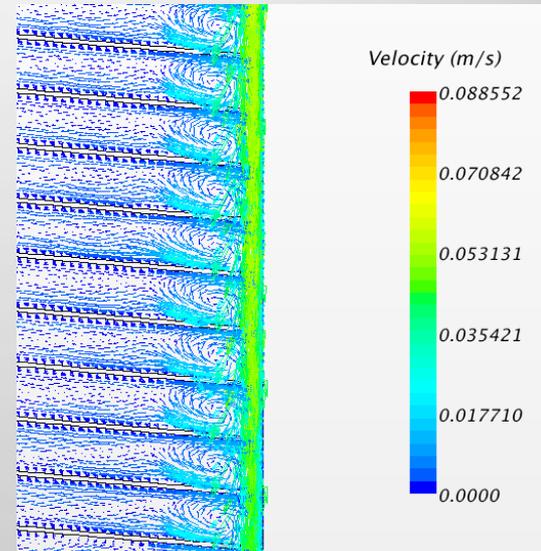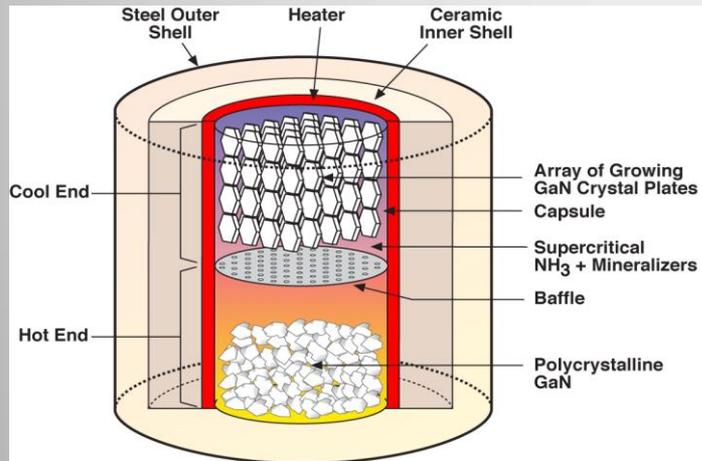
- **Industry partner: SORAA**

- **Scale-up of GaN crystal growth technology could result in a 20% reduction in production costs of highly efficient, high brightness LED lighting. Next generation power electronics for renewables will also be enabled.**

- **LLNL researchers are modeling the chemical processes in the ammonothermal crystal growth process to assist in process scale-up.**

- **A new high-fidelity model will save the years of trial-and-error experimentation typically needed to facilitate large-scale commercial production.**

SORAA®
Simply Perfect Light™

Steel Outer Shell · Heater · Ceramic Inner Shell · Cool End · Hot End · Array of Growing GaN Crystal Plates · Capsule · Supercritical NH_3 + Mineralizers · Baffle · Polycrystalline GaN
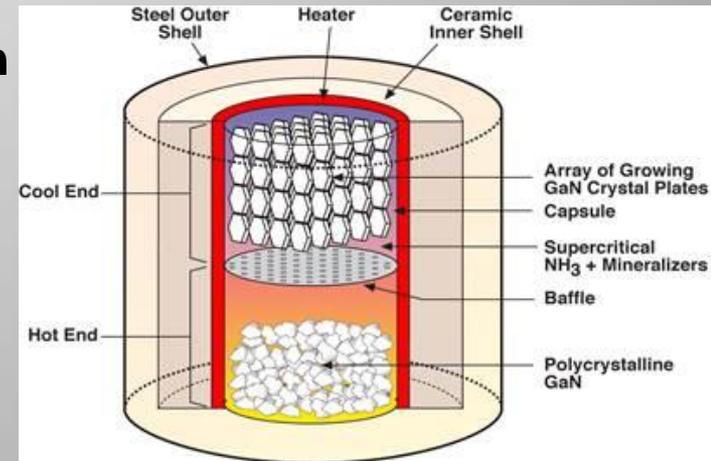
Models have been developed to determine the flow within the ammonothermal reactor

- **Our higher fidelity simulations show more complicated flow structure than previous simulations improving predictions of the local temperatures and flow velocities within the reactor.**
- **This new information is being used to optimize uniform growth of GaN.**

For more information on the HPC4Mfg Program

- **Access hpc4mfg.llnl.org**

- **Join the hpc4mfg-info@llnl.gov distribution list via the web to receive program announcements**

- **Contact hpc4mfg@llnl.gov**

Q & A

- Please mute your phone when not speaking

- Questions: Send to "Everyone" via Chat

- Please "raise your hand" (hand icon) if you would like to join the dialogue and I will call on you

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