



superior performance.
powerful technology.

2G HTS Wire Design and Engineering for Electric Power Applications

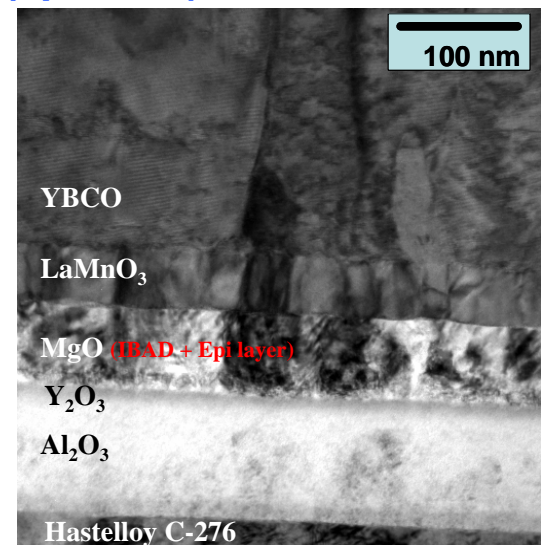
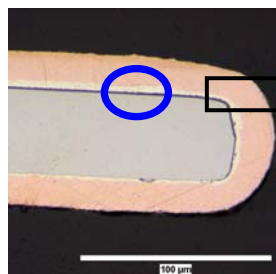
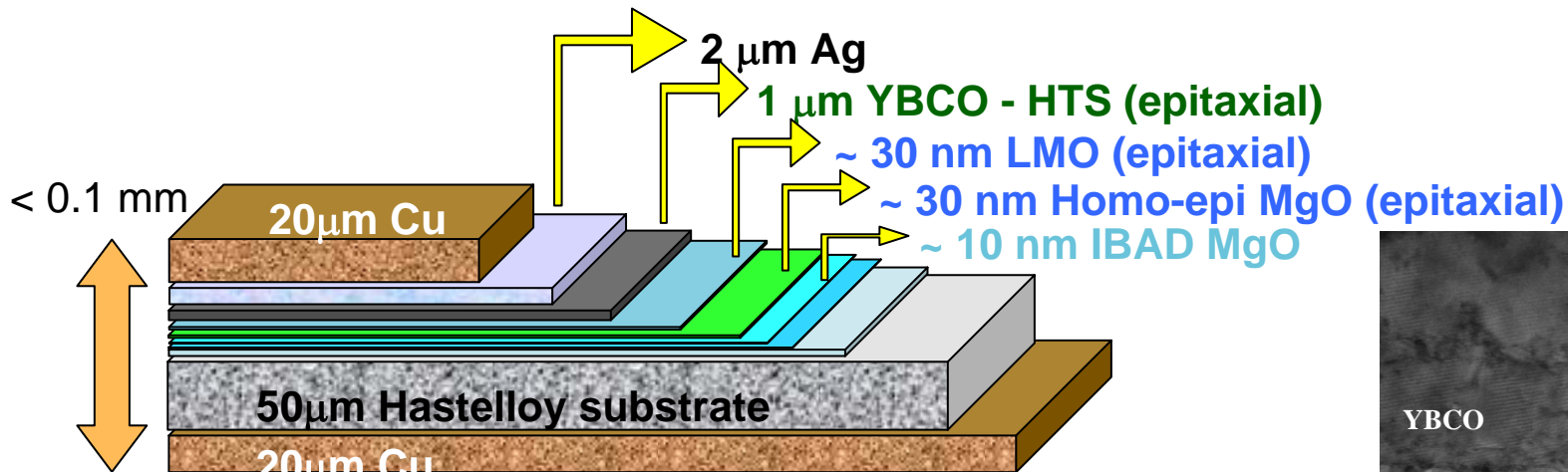
Yi-Yuan Xie

M. Marchevsky, X. Zhang, K. Lenseth, Y. Chen, X. Xiong, Y. Qiao, A. Rar,
B. Gogia, R. Schmidt, A. Knoll, J. C. Llambes, D. Hazelton, and V. Selvamanickam

Applied Superconductivity Conference 2008
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August 18-22, 2008

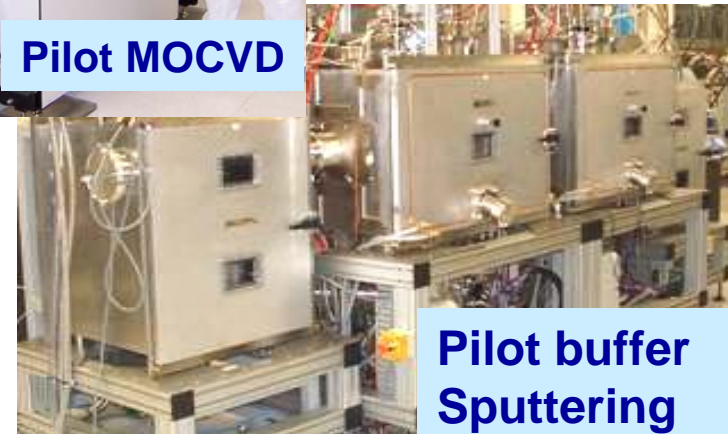
SuperPower's 2G wire is based on high throughput processes & superior substrate

- High throughput is critical for low cost 2G wire and to minimize capital investment
- SuperPower's 2G wire is based on high throughput IBAD MgO and MOCVD processes
- Use of IBAD as buffer template provides the choice of any substrate
- Advantages of IBAD are high strength, low ac loss (non-magnetic, highly resistive substrates) and high engineering current density (ultra-thin substrates)



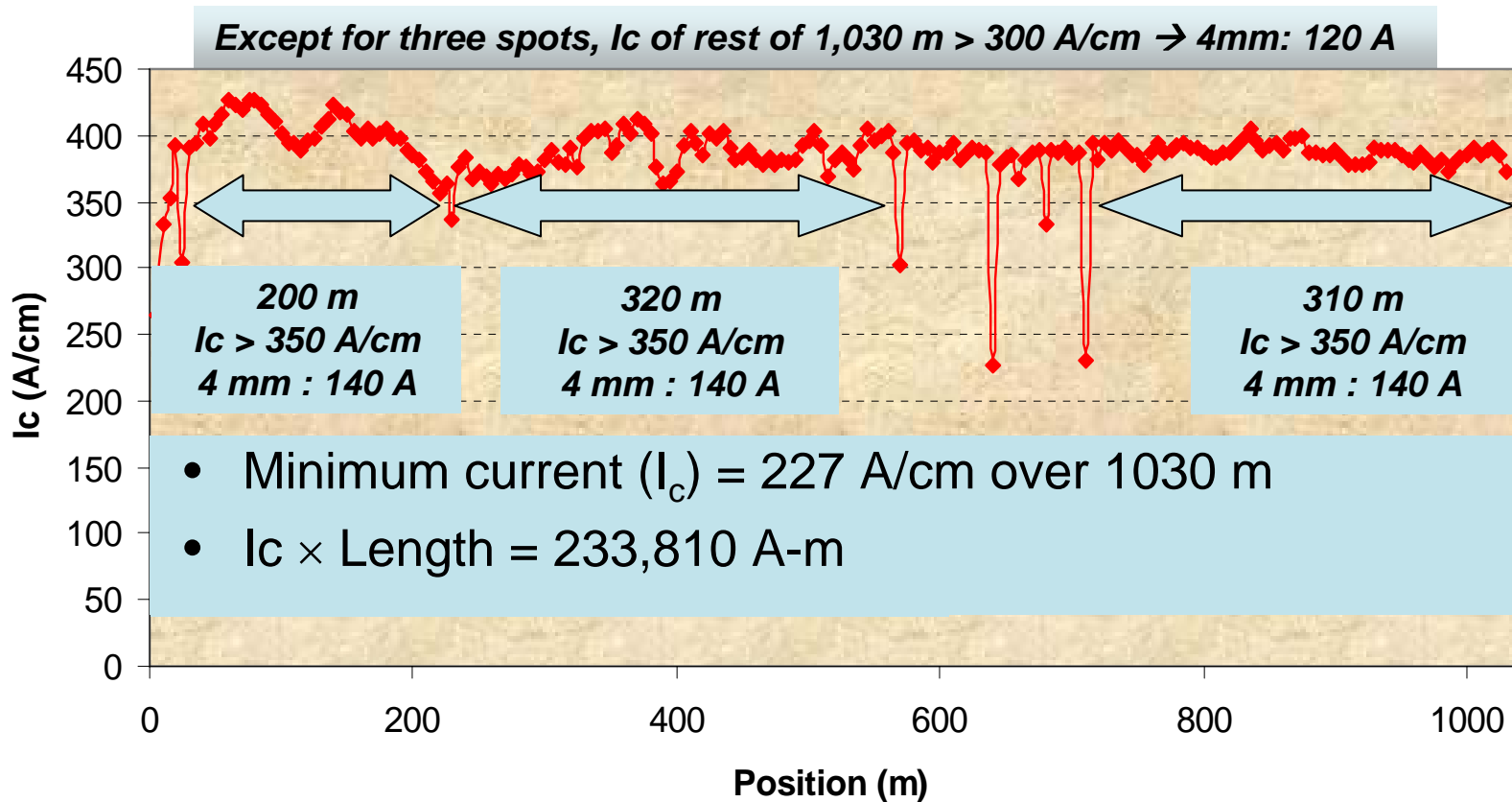
SuperPower's 2G pilot manufacturing facility has been operational since 2006

- Majority of investment already made for 1000 km/year capability



- 30 m cable manufactured with ~10,000 m of SuperPower 2G HTS wire was energized in Jan. 2008 (**1LB02**, C.S. Weber, 11:00am, Mon., 8/18)
- High-field insert coil with record high 26.8 T field at 4.2 K (**3LY01**, 4:00pm, Wed., 8/20)

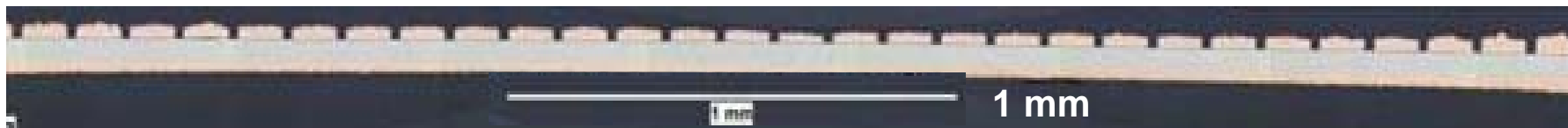
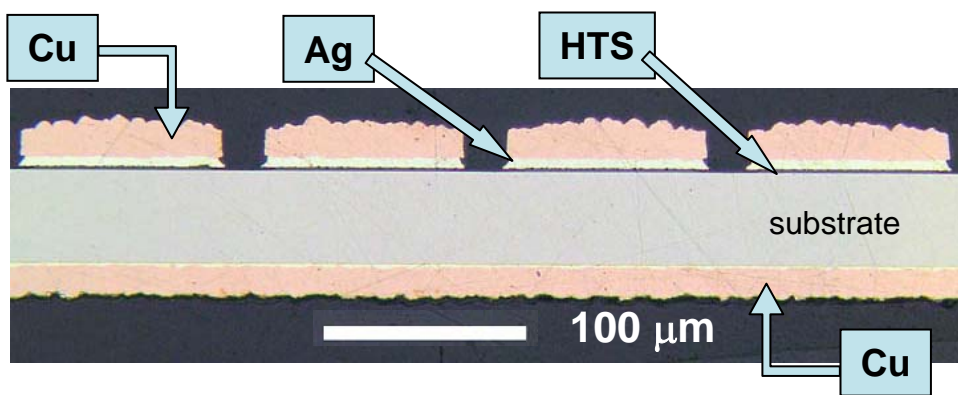
July - Aug. 2008: Crossed kilometer threshold and achieved new world-record performances!



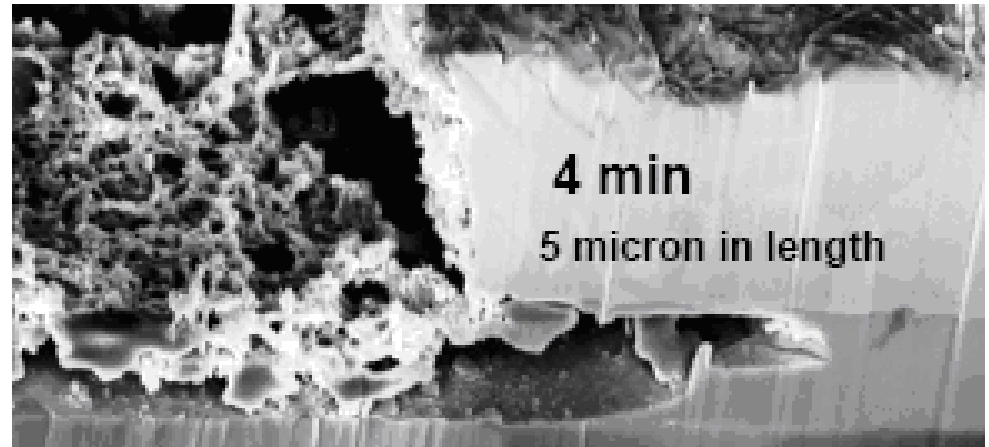
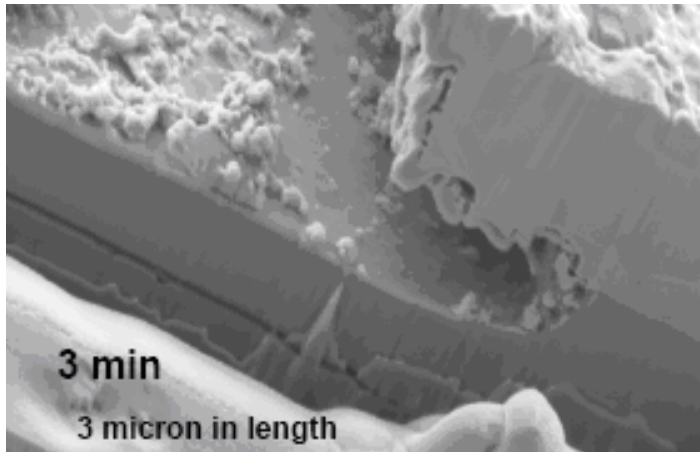
- Improve performance/cost ratio;
- Develop practical conductors for different applications
 - ac tolerant conductor
 - Joints
 - Insulation

Meeting customer performance requirements for ac tolerant 2G wire: multifilamentary wires

- Multifilamentary 2G wire has been demonstrated in short lengths by many institutions
- SuperPower previously demonstrated multifilamentary wire even with a thick copper stabilizer, in lengths of up to 30 cm



Challenges with scalability of multifilamentary 2G wire



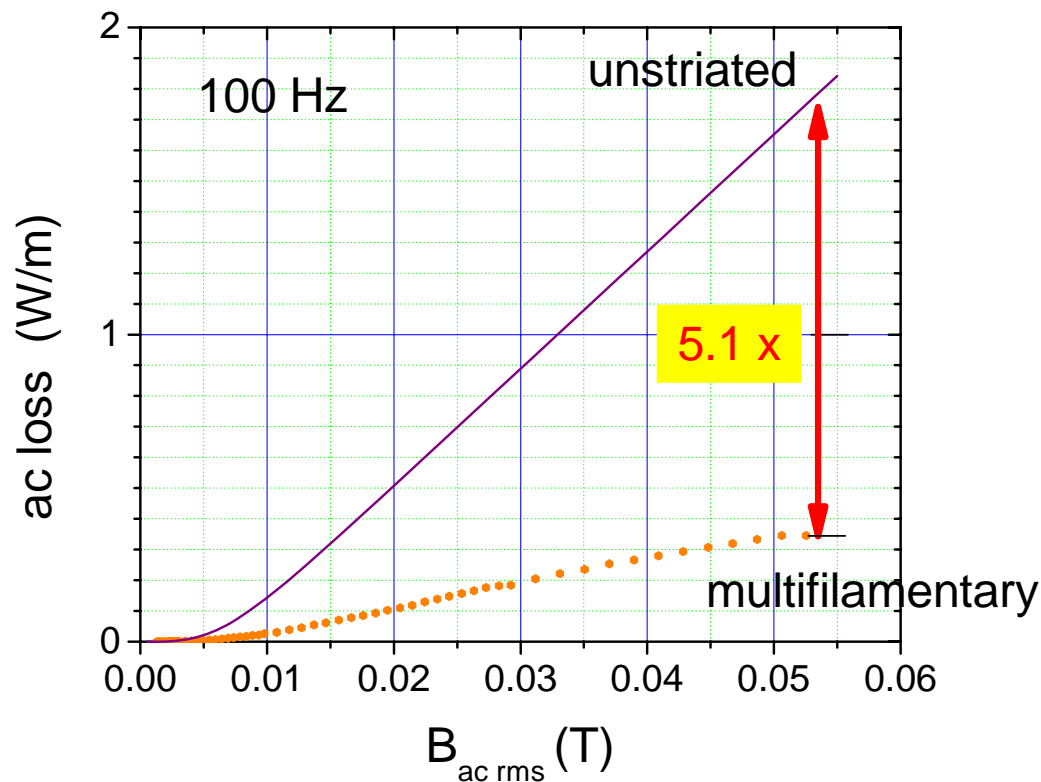
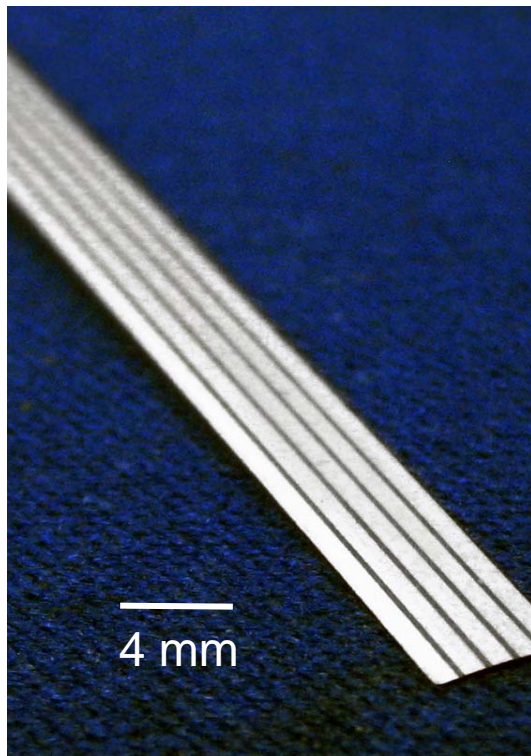
Provided by G. Pethuraja and P. Dutta at Rensselaer Polytechnic Institute

- Residues in interfilamentary spacings lead to lower ac loss reduction
- Undercutting of filaments can decrease I_c
- Repeatability of the process is a major challenge for scale-up to long lengths

New process developed for scalability of multifilamentary 2G wire

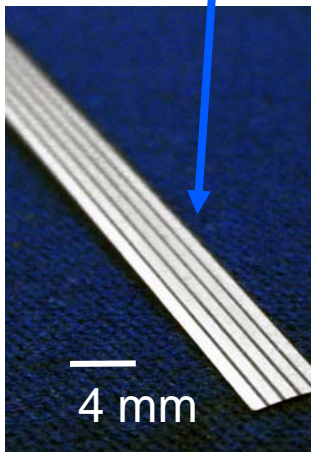
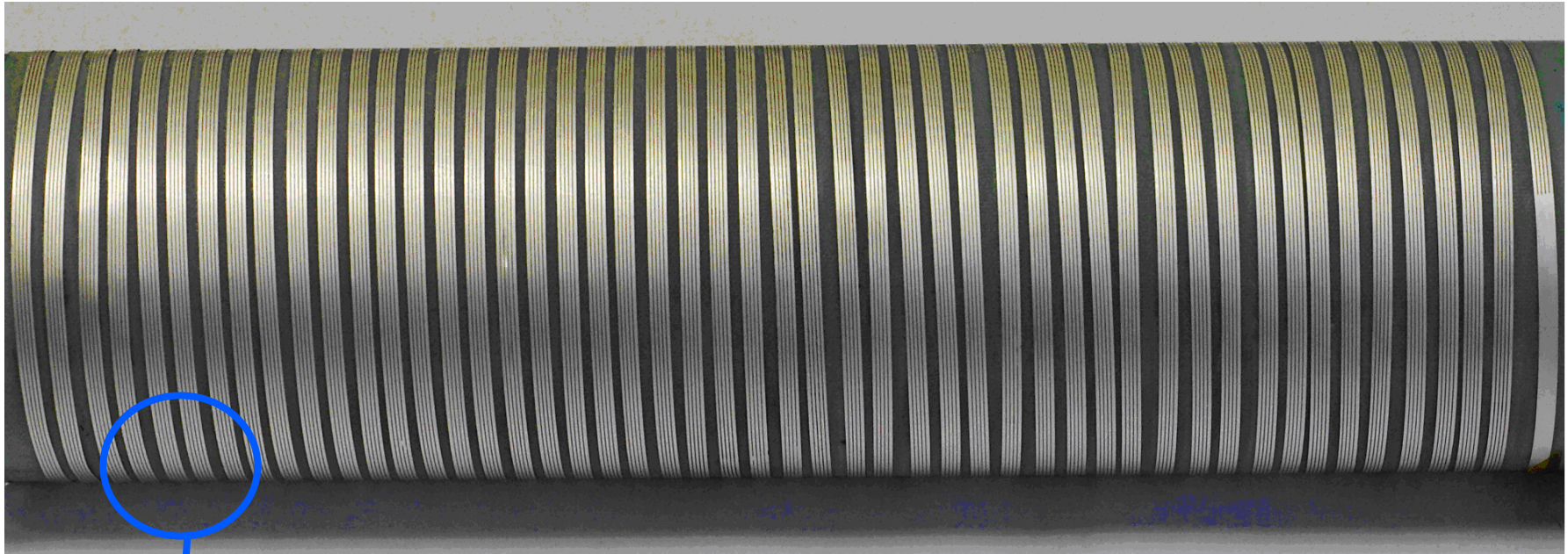
- Industrial process
- Using coarse filament geometry now – 5 filaments in a 4 mm wide wire

650 - 800 micron filaments & 100 - 125 micron trenches.



Process & performance are very repeatable

Continuous multifilamentary 2G wire is now scaled to 15 m lengths



- Good I_c and reasonable ac loss reduction achieved
- Coils were made with long length multifilamentary wires, showed lowered ac loss in magnetic field and with transport ac current as reported at DOE Peer Review (July 2008)