Improvised Electrospinning Set up for Thicker Ceramic Nanofiber Mat for High Power Targets

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Introduction and Objectives

• In high energy particle physics there is a demand for multi-MW high performance particle production targets.
• Nanofiber microstructure will have better performance than current solid targets in mitigating increased thermal stress waves, radiation damage.
• Objective is to fabricate thicker ceramic/metallic nano-fiber with high strength, thermal shock resistance using low cost electrospinning process.

Introduction and Objectives

Electrospinning process

• Process carried out at room temp. and atm. pressure

Thicker mat with ionizer

• Rotating drum collector brings the positively charged nanofiber to negatively charged ions / nanofibers and neutralize them

Improvised electrospin set up

• Much safe to use (120W → 4W!)
• Mobile compact unit → Can be run on 9 or 12 V battery
• Dual polarity operation

Summary and Future work

• Set up a low cost, low power, safer electrospinning unit.
• Success in fabricating metallic and ceramic nanofiber.
• Thicker nanofiber production using dual polarity spinning.
• Ceramic nanofiber looks promising as future candidate target material.

Future work

• Single fiber bending test for tensile strength.
• Single fiber thermal properties evaluation.
• Radiation damage studies using ion irradiation.

Ceramic/metallic nanofiber production

Inorganic precursor:
(Zirconia Carbonate + Acetic Acid → Zirconia)

Polymer solution: PVP+Ethanol/Aceton

Calcination (Heat treatment)