

## **Metal Research Group**

- Our laboratory was established in the Physics Department, Faculty of Science, Mansoura University, Mansoura, Egypt. Many precision techniques (manual and fully automate) and devices were designed to study the mechanical and electrical behavior.
- Our research group seek for use low-cost, scalable solution processing techniques to develop new metallic materials towards applications including electronics, biomaterials, biomedical (dental and orthopedic) and space applications.
- Team of the research group focus on the development, manufacturing as well as study of structural, microstructural, mechanical behavior, thermal stability and electrical properties of metallic alloys using two unique methods:
  1. Rapid solidification Technology using melt-spun technique.
  2. Powder Metallurgy (PM) Technology.
- A major technique used in the formation and the production of the metallic alloys (long thin ribbons) with a particular atomic structure by rapid solidification technology using melt-spinning technique because several advantages of it such as, direct, and simple process, high production speed, low investment cost, no environment pollution. Rapid Solidification Technology (RST) is an important and growing area, especially in new and

development materials. Also, powder metallurgy technology: A novel technique to synthesize advanced materials and offers advantages over conventional processing. Metal powders are used in many manufacturing techniques in order to produce metal parts. Use of metal powders eliminates waste in comparison with traditional machining and is versatile in creating a variety of metal and alloy components. Metal powder technologies are at the forefront of the progressive era of a smarter and greener fabrication.

- Finally, this research group involves strong collaborations with other departments in Mansoura University and other universities in Egypt and abroad. Precision techniques (manual and Digital) are being developed for the measurements of mechanical behavior, electrical resistivity, thermal stability and creep of the various types of new metallic materials rapidly solidified from molten state, for application in biomaterials and biomedical (Dental and Orthopedic applications), bearing, soldering, fusible, electronics (space applications), microelectronics and in the construction of x-ray and electron radiotherapy shielding.

**Research currently being undertaken includes the following topics:**

1. Lead-free solders for electronic applications.
2. Assembly Options and Challenges for Electronic Products with Lead-free Exemption.

3. Effect of different nanoparticles on interfacial intermetallic compound growth and mechanical behavior of lead-free solder joints.
4. Preparation and characterization of some aluminum-based antifriction (bearing) alloys by mechanical press.
5. Advances in lead-free electronics soldering.
6. Lead-Free Soldering for Space Applications.
7. Aluminum alloys for bearing.
8. Shielding alloys for radiotherapy medical applications.
9. Biomaterials for dental and orthopedic applications.
10. Evaluation of Some Physico-Mechanical Properties of a Bulk-Fill Composite Resin Restorative Material.
11. Physical study on low melting alloys as shielding blocks for mega voltage therapy machines.
12. Investigation of Structure and Dynamic Properties in Conjugated polymers and graphene/ polymers nanocomposites for solar cells applications
13. Tuning the electrochemical anodization parameters to produce TiO<sub>2</sub> nanotubes array with novel properties like higher conductivity and large nanotubes diameter.
14. Improving conductivity of TiO<sub>2</sub> nanoparticles by using doping method during sol-gel synthesis.
15. Manufacturing and developing more efficient Dye-sensitized solar cells (DSSCs) by hybridizing between two different nanostructured materials (e.g. TiO<sub>2</sub> nanotubes and nanoparticles).

## أعضاء المجموعة البحثية

الوظيفة	التخصص	الاسم	م
أستاذ بالقسم ووكيل الكلية لشئون البيئة وخدمة المجتمع	فيزياء الفلزات	أ.د/ رزق مصطفى ابراهيم السيد	1
مدرس بالقسم	فيزياء	د.عبد الحميد عبد الرحمن أحمد الزرقا	2
مدرس بالقسم	فيزياء	د. نرمين على عبد الحكيم على	3
مدرس مساعد بالقسم	فيزياء	أميرة محمد محمد الشرييني	4
معيد	فيزياء	محمد حافظ محمد حافظ العشرى	5