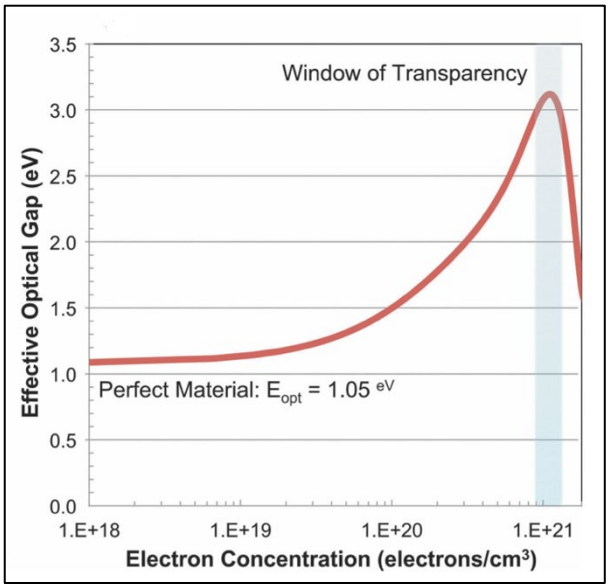
**A new transparent conductive material for improved solar cells**

**About the project or challenge area:** The most important challenge currently facing humanity is that of climate change. To help fight climate change, the UK has a target to achieve zero carbon emissions by 2050, but this will require a paradigm-shift in the way that energy is generated, supplied, used and stored. One of the first and most important steps we can take is to fast-track the development of green energy technologies that decarbonize our energy supply and facilitate the deployment of more advanced renewables. This objective is at the heart of the European Green Deal and in line with the EU's commitment to global climate action under the Paris Agreement. Transparent conductive oxide (TCO) is a material that has been essential in the development of devices such as solar cells, flat panel displays and light emitting diodes, but there is a problem. The current industry standard TCO is indium tin oxide, which given the gargantuan demand for TCOs, coupled with the low abundance of indium on Earth, has made indium incredibly expensive, which has led to an intensive search for alternatives. One such conductive material could be cheap and readily available $PbO_2$, but it is a grey material and not transparent. A theory paper from 2013 (*Chem. Commun.*, 2013, **49**, 448-450) suggested that there is a narrow window of doping in which $PbO_2$ would become transparent, but to-date, the successful synthesis of this has not been achieved. Recent research at Bristol, however, has shown that inorganic materials can be synthesized with exquisite control over composition, even up to quaternary and quinternary compounds. This immediately opens the opportunity to synthesize transparent $PbO_2$.




**Why choose this opportunity?** The focus of your project will be on the synthesis of transparent $PbO_2$ which will allow you to learn about the rational design of functional materials and their performance as TCOs. Your work in this area can make a real impact on the global challenge of climate change. You will develop and increase your expertise in sol-gel and solid-state syntheses and characterization techniques, whilst becoming familiar with the fundamentals of conductive oxides. Furthermore, this project will require your collaboration with other members across other research groups, thus improving your teamwork and networking skills. You will also develop a range of transferable skills, including presentation, scientific writing, and project and time management. Finally, you will be interacting with students from all over the world learning from their culture and skills, adding to your professional and personal development. Full training will be provided for all aspects of this project. You will be embedded in the Supervisor's research group, who will provide support. In addition, you will be assigned a mentor for the duration of your project, who will provide extra support and help you to identify any additional training needs or opportunities.

**About you:** Ideally you will already have skills and knowledge in general chemistry, and analytical methods, along with teamwork and time management.

**Bench fees:** A bench fee of £5,500 is required.

**How to apply:** Applications are accepted throughout the Academic Year, and you should complete the online application form for Chemistry (MSc by Research).

**Supervisor:** Your supervisor for this project will be Professor Simon Hall, in the School of Chemistry. You can contact him via email - simon.hall@bristol.ac.uk

**Find out more about your prospective research program:** This recent article showcases our method of inorganic compound synthesis:

*Facile synthesis of five strontium niobate metastable crystal compositions via sol-gel ionic liquid synthesis*

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