

**Opportunity Title:** 2D Materials for Information Security

**Opportunity Reference Code:** ICPD-2020-16

**Organization** Office of the Director of National Intelligence (ODNI)

**Reference Code** ICPD-2020-16

**How to Apply** **Create and release your Profile on Zintellect** – Postdoctoral applicants must create an account and complete a profile in the on-line application system. **Please note: your resume/CV may not exceed 2 pages.**

**Complete your application** – Enter the rest of the information required for the IC Postdoc Program Research Opportunity. The application itself contains detailed instructions for each one of these components: availability, citizenship, transcripts, dissertation abstract, publication and presentation plan, and information about your Research Advisor co-applicant.

Additional information about the IC Postdoctoral Research Fellowship Program is available on the program website located at:  
<https://orise.ora.gov/icpostdoc/index.html>.

If you have questions, send an email to [ICPostdoc@ora.gov](mailto:ICPostdoc@ora.gov). Please include the reference code for this opportunity in your email.

**Application Deadline** 2/28/2020 6:00:00 PM Eastern Time Zone

**Description** **Research Topic Description, including Problem Statement:**

The goal of this research is to develop novel materials to secure information from surveillance with a particular focus on windows. Historically, it has been difficult and expensive to build windows with a high level of transparency in the visible spectrum that effectively block electromagnetic radiation from the rest of the spectrum. There are a limited number of products on the market for just such a purpose. Low emissivity or low-E films, while not explicitly designed for this purpose, do offer some degree of radio frequency (RF) attenuation. Coincidentally, there has been an explosion of research in the area of graphene and other 2D materials such as the dichalcogenides because of the large achievable mobilities and tunable bandgaps. Such materials appear to have promise for the tunable, frequency dependent attenuation of electromagnetic radiation. In particular and in contrast to traditional materials, 2-D materials have demonstrated that the higher the dc conductivity, the more visibly transparent they become. Beyond the difficult problem of optimizing the tailored response over the entire frequency range, scalability will also be a major challenge. A second focus could be the development of smart windows that adapt to their environment or that act to serve a dual function such as detection of surveillance attempts.

**Example Approaches:**

- Graphene can be doped passively by contact with other materials such as sodium glass to enhance the DC conductivity. Chemical vapor deposition (CVD) is a scalable technique to grow graphene on copper foils. Glasses or other dielectrics can be applied by the "spin-on" technique.
- Multiple layers of different 2D materials such as graphene and polyethylene terephthalate (PET) could be utilized to enhance performance.




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- 2D materials could be combined with metal meshes and/or metal/dielectric layers to enhance performance. Metal meshes can be fabricated with traditional photolithography.
- Hyperthermal ion implantation (HyTII) could potentially be used to further dope graphene and other 2D materials. Multiple beam systems could allow such an approach to scale to large surfaces.

**Relevance to the Intelligence Community:**

If successful, results will improve the ability to prevent electromagnetic transmission of information into and out of its secure facilities.

**Key Words:** Radio Frequency (RF), Shielding, Transmittance, Reflection, Graphene, Dichalcogenides, Low Emissivity

## Qualifications

### Postdoc Eligibility

- U.S. citizens only
- Ph.D. in a relevant field must be completed before beginning the appointment and within five years of the application deadline
- Proposal must be associated with an accredited U.S. university, college, or U.S. government laboratory
- Eligible candidates may only receive one award from the IC Postdoctoral Research Fellowship Program

### Research Advisor Eligibility

- Must be an employee of an accredited U.S. university, college or U.S. government laboratory
- Are not required to be U.S. citizens

## Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Discipline(s):**
  - **Chemistry and Materials Sciences** (12 )
  - **Communications and Graphics Design** (2 )
  - **Computer, Information, and Data Sciences** (16 )
  - **Earth and Geosciences** (21 )
  - **Engineering** (27 )
  - **Environmental and Marine Sciences** (14 )
  - **Life Health and Medical Sciences** (45 )
  - **Mathematics and Statistics** (10 )
  - **Other Non-Science & Engineering** (2 )
  - **Physics** (16 )
  - **Science & Engineering-related** (1 )
  - **Social and Behavioral Sciences** (27 )