

**AFRL/DAGSI Research Topic Call for FY20**

1. **Research Title:** Metal-oxide thin-film transistors
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Electrical engineering, materials science, or applied physics (Ph.D. level).
4. **Objectives:** Wide bandgap transition-metal oxides, such as ZnO and InGaZnO, have high dielectric breakdown strength, and even as nanocrystalline or amorphous thin films, they can retain electronic transport properties similar to single crystalline values due to ionic bonding and overlap between isotropic metal s orbitals. Metal oxide thin-film transistors (MOTFTs) operate in the enhancement mode while showing promise for a variety of dc and rf switching applications, especially those that can leverage their low-temperature, substrate-agnostic process integration potential. Higher levels of integration, new functionality, and/or reduced cost can be achieved by fabricating MOTFTs directly: 1) on another complementary semiconductor technology whose native switching transistors are inadequate; 2) where loss incurred by going off-chip among packaged devices is unacceptable; or 3) onto substrates with favorable thermal or dielectric properties or substrates optimized for passives in cases where considerable passive circuitry is demanded (e.g., true time delay circuits for phased array radars). The overall goals of this research are to 1) identify fundamental electronic transport and reliability limitations of MOTFTs, 2) optimize their performance and reliability based on understanding of these limitations, and 3) design, model, and implement high-performance integrated circuit concepts involving MOTFTs.
5. **Description:** This project involves research from the fundamental semiconductor device level to the circuit level. AFRL/Ry's state of the art microelectronics cleanroom and characterization/test facilities will be leveraged by chosen fellow. Applicant should have interest and appropriate course background in one or more of the following areas: semiconductor device physics, microelectronic fabrication, power electronics, rf electronics, circuits, and materials science.
6. **Research Classification/Restrictions:** This research is anticipated to be fundamental in nature, with no inherent publication or presentation restrictions. There may be aspects that are deemed FOUO and have public release or ITAR restrictions, although this is unlikely and such areas could be avoided if needed.
7. **Eligible Research Institutions:** Universities (DAGSI), AFIT, USAFA
8. **Interest in Summer USAFA Cadet:** Yes, if funding is available