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Title	Project title: **NATO Science for Peace and Security Programme (SPS) under grant G5634 „Advanced Electro-Optical Chemical Sensors" AMOXES** Research title: **A single $CuO/Cu_2O/Cu$ micro-wire covered by a nano-wire network as gas sensor for the detection of battery hazards**
Authors	LUPAN Oleg, ABABII Nicolai.
Institution	**Technical University of Moldova**
Patent no.	-
Description EN	In this research, a strategy to prepare $CuO/Cu_2O/Cu$ microwires which is fully covered by a nanowire network using a simple thermal oxidation process is developed. The $CuO/Cu_2O/Cu$-microwires are fixed on Au/Cr pads with Cu microparticles. After thermal annealing at 425 °C, these $CuO/Cu_2O/Cu$ microwires are used as room-temperature 2-propanol sensors. These sensors show different dominating gas responses with operating temperatures, to ethanol at 175 °C, to 2-propanol at room temperature and 225 °C, and to hydrogen gas at ~ 300 °C, respectively. We propose the sensing mechanism of this 3-in-1 sensor based on $CuO/Cu_2O/Cu$. XRD studies reveal that the annealing time during oxidation affects the chemical appearance of the sensor, thus that for samples oxidized at 425 ºC for 1 h the dominating phase is Cu_2O, whereas upon further rising the

annealing duration up to 5 h, the CuO phase becomes dominant. The crystal structure of the Cu_2O-shell/Cu-core and the CuO-NWs networks on the surface were confirmed with TEM, HRTEM, and SAED. DFT calculations brings valuable inputs to the interactions of the different gas molecules with the most stable topsurface of CuO, revealing strong binding, electronic band gap changes and charge transfer due to the gas molecule interactions with the topsurface. This research shows the importance of the non-planar CuO/Cu_2O layered hetero-structure as a bright nanomaterial for the detection of various gases, controlled by the working temperature, and the insight presented here will be of significant value in the fabrication of new p-type sensing devices through simple nanotechnology.