

## **Mineral deposits evaluation to assess rare metals availability for their use in photovoltaic solar cells**

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Sunlight is one of the greatest source of current and future energy resources of the world. Depletion of non-renewable commodities including fossil fuels, nuclear fuel and up to some extent water has placed a greater stress on the production of electricity from renewable sunlight. The World Bank’s Global Tracking Framework calculated that 24816.4 terawatt hours of electricity were generated in 2016 with 1.06 billion people continuing to live without electricity. Worldwide dependency on fossil fuel generated electricity is rapidly declining due to strict environmental policies, according to the International Energy Agency electricity production from renewable resources will be increased by 50% between 2019 and 2024 owing to its massive and widespread availability. To affirm inexhaustible solar generated electricity over 3000 US billion dollars are expected to be invested on solar power generation technologies up to 2040 (BNEF New Energy Outlook 2017). The rare metals such as cadmium, indium, gallium, selenium, germanium and tellurium are the important mineral commodities used in current photovoltaic cells technologies. These mineral commodities are recovered as by-product from the zinc-lead-copper, bauxite and coal/graphite deposits. Global demand of thin-filmed photovoltaic cells is increasing due to their flexible usage in homes, agriculture, highways/streets lights, traffic lights, hot water geysers, solar power parks, highly sophisticated equipment, cars, satellites, ships, spacecrafts, trains etc.

Pakistan has such a geotectonic setup where there is a greater potential for occurrence of the zinc-lead-copper, bauxite and coal/graphite deposits which could be investigated for the recovery of rare metals for their use in photovoltaic cells. Therefore, the main focus of the current research is to explore the rare metals cadmium, germanium, indium, gallium, selenium and tellurium in their host deposits such as zinc–lead- copper, bauxite and coal/graphite deposits of Pakistan. These deposits are mined for their major components in Pakistan, however, the occurrence and separation of these rare metals during the metallurgical processes are not given any importance to be recovered. Consequently, no exploration and extraction of these rare metals have been carried out so far in Pakistan. This research on one hand will be helpful in value addition of already occurring zinc, lead, copper, bauxite and coal/graphite deposits of Pakistan but on other hand it also brings Pakistan among the countries producing different types of commodities for preparation of photovoltaic cells.

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