

**Zgłoszenie zagadnienia badawczego realizowanego
w Krakowskiej Interdyscyplinarnej Szkole Doktorskiej
w dyscyplinie ...fizyka.....**

w Jednostce: ...Instytut Fizyki Jądrowej PAN

1	Nazwisko i imię promotora, tytuł/stopień naukowy, jednostka, adres e-mail	Magdalena Parlińska-Wojtan, prof. dr hab. inż. magdalena.parlinska@ifj.edu.pl
2	Nazwisko i imię promotora pomocniczego (opcjonalnie), jednostka, adres e-mail	
3	Temat zagadnienia badawczego+ krótki (do 250 słów) opis tematyki badawczej	<p>Mechanizm reakcji wymiany galwanicznej w pustych nanocząstkach badany in-situ transmisyjną mikroskopią elektronową i rentgenowską</p> <p>W proponowanym projekcie nowe, puste nanocząstki Cu₂O w kształcie nanokostek zostaną zsyntezowane metodą mokrej chemii.</p> <p>In the present project novel hollow nanoparticles, based on Cu₂O nanocubes, will be produced by wet chemistry syntheses. These Cu₂O template nanocubes, will be transformed via galvanic replacement reaction (GRR) with Pt, Pd, Au and Ag into hollow Pt@Cu₂O, Pd@Cu₂O, Au@Cu₂O and Ag@Cu₂O nanoskeletons. The basic research aim of the project is to understand the mechanism of the GRR leading to the formation of hollow nanoparticles. We will apply a novel approach, which is imaging in-situ the course of GRR between noble metal elements (Pt, Pd, Au and Ag) and Cu₂O template nanocubes at nanoscale resolution using liquid cell transmission electron microscope (LC-TEM) and scanning transmission X-ray microscopy (STXM) technique at the synchrotron. These observations will allow us to establish, which parameters control the efficiency of NPs hollowing process, taking into account the effects of electron or X-ray beam on the GRR. The groundbreaking idea is to compare the effect of those two beams on the GRR course in nanoparticles, providing fundamental knowledge on the mechanism of GRR.</p>
4	Wymagania w stosunku do kandydata (wykształcenie, umiejętności/kursy)	ukończone studia magisterskie na kierunku fizyka / chemia / inżynieria materiałowa / nanotechnologia / biotechnologia znajomość języka angielskiego umożliwiającą czytanie oraz zrozumienie najnowszych prac naukowych

		zdolności manualne / laboratoryjne chęć do samokształcenia się oraz do pracy zaangażowanie
5	Wskazanie możliwych źródeł i zakresu finansowania spoza subwencji, np. stypendium naukowego, kosztów badań, wyjazdów itp.	Stypendium doktoranckie NCN 3 lata. (2024-2026)

1	Supervisor: name/surname, degree, affiliation, e-mail address	Prof. Magdalena Parlinska-Wojtan Institute of Nuclear Physics Polish Academy of Science e-mail: magdalena.parlinska@ifj.edu.pl
2	Auxiliary supervisor (optional) affiliation,e-mail address	
3	Research subject title Short description, up to 250 words	<p style="text-align: center;">Galvanic replacement reaction mechanism in hollow nanoparticles studied by liquid-cell in-situ transmission electron and scanning X-ray microscopies</p> <p>In the present project novel hollow Cu₂O nanoparticles, having a shape of nanocubes, will be produced by wet chemistry syntheses. These Cu₂O template nanocubes, will be transformed via galvanic replacement reaction (GRR) with Pt, Pd, Au and Ag into hollow Pt@Cu₂O, Pd@Cu₂O, Au@Cu₂O and Ag@Cu₂O nanoskeletons. The basic research aim of the project is to understand the mechanism of the GRR leading to the formation of hollow nanoparticles. We will apply a novel approach, which is imaging in-situ the course of GRR between noble metal elements (Pt, Pd, Au and Ag) and Cu₂O template nanocubes at nanoscale resolution using liquid cell transmission electron microscope (LC-TEM) and scanning transmission X-ray microscopy (STXM) technique at the synchrotron. These observations will allow us to establish, which parameters control the efficiency of NPs hollowing process, taking into account the effects of electron or X-ray beam on the GRR. The groundbreaking idea is to compare the effect of those two beams on the GRR course in nanoparticles, providing fundamental knowledge on the mechanism of GRR.</p>

4	Additional requirements to the candidate (education, skills / courses)	Completed MSc studies in the field of physics / chemistry / materials engineering / nanotechnology / biotechnology English knowledge allowing reading and understanding scientific papers manual / laboratory skills willing to develop self-education and to work involvement
5	Possible sources of financing, other than subsidy, e.g., scientific scholarship, research and travel costs, etc.	Project, 3 years (2024-202)