

# Horizon 2020 ERC PoC case study

3D Cer-MET: Thin-Walled Ceramic and Ceramic-Metal  
Components using Electrolytic Plasma Processing

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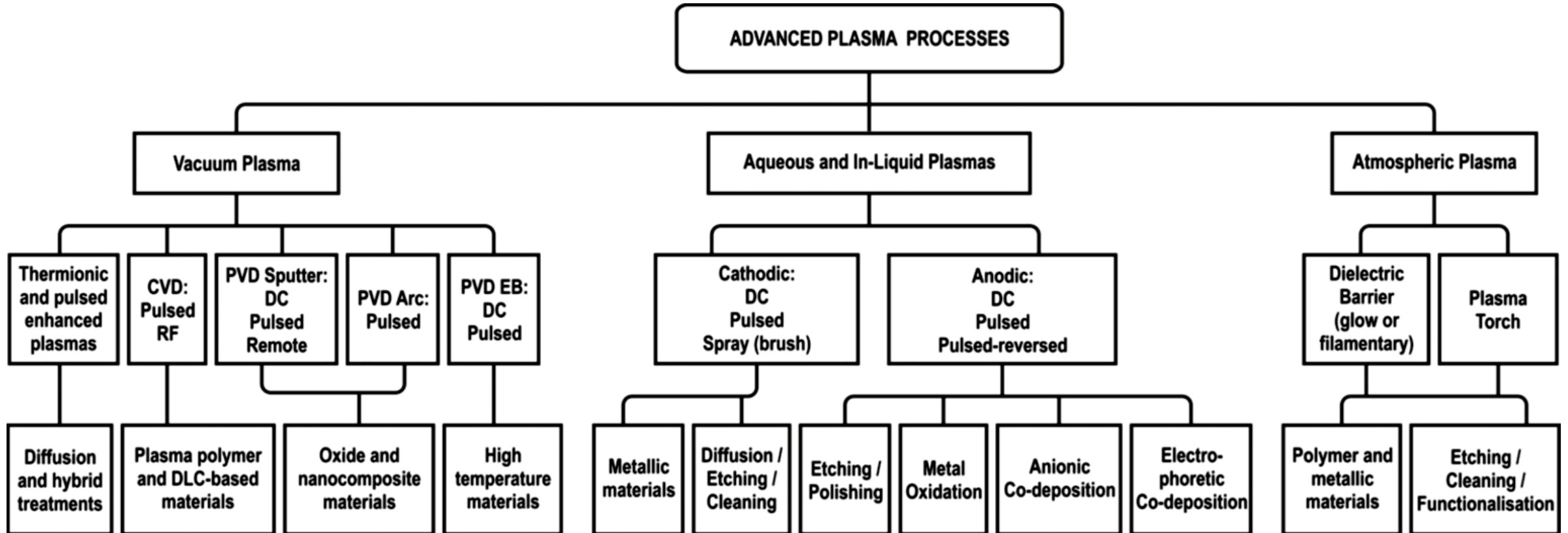
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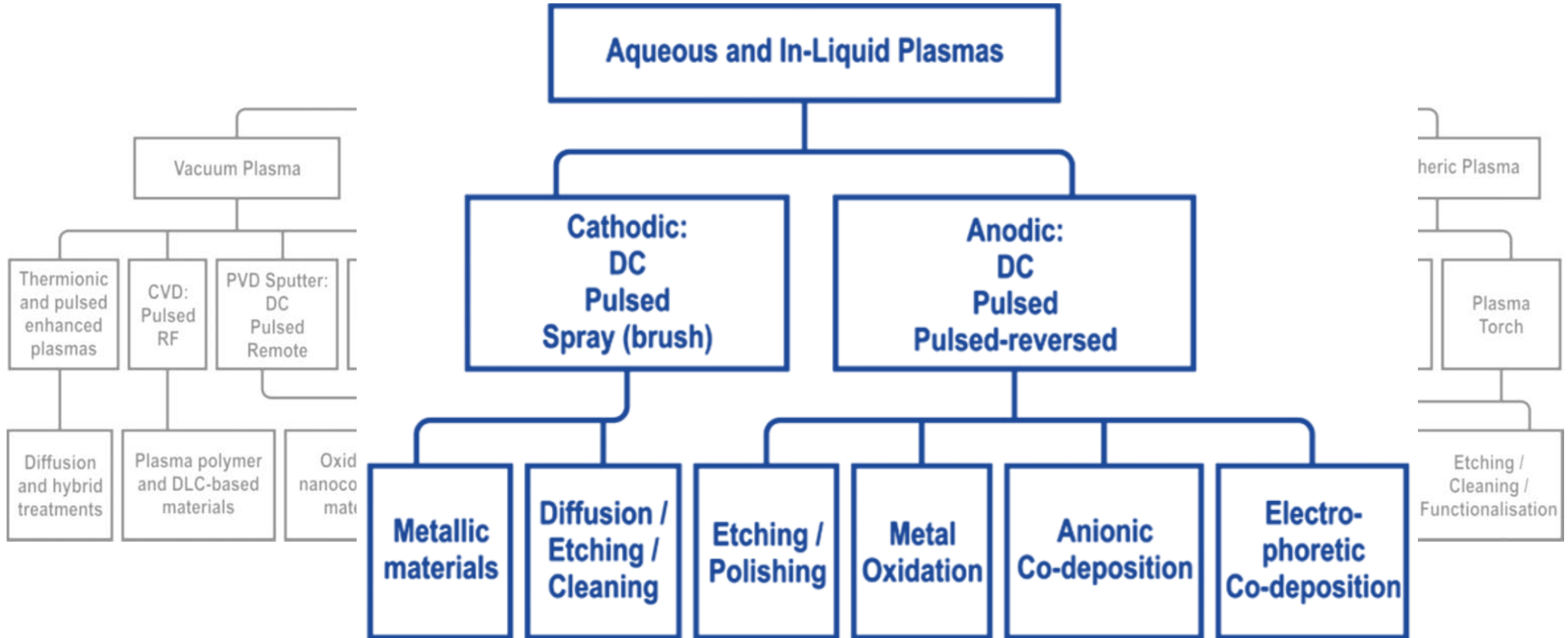
# The origin of PoC - ERC Advanced Grant

- **Title:** Innovative Materials Processing Using Non-Equilibrium Plasmas (IMPUNEP)
- **Term:** Feb 2013 – Sept 2018
- **Host:** initially Sheffield University (moved to Manchester University in July 2016)
- **Aim and objectives:**
  - To study novel methods for processing of engineering materials, using advanced non-equilibrium plasma systems, to achieve paradigm shift in materials synthesis
- **Principle Investigator:** Prof Allan Matthews
- **Team:**
  - Prof Frank Jones & Dr Alison Beck - *Atmospheric Plasma* processes
  - Dr Adrian Leyland - *Vacuum Plasma* processes
  - **Dr Aleksey Yerokhin - *In-liquid Plasma* processes**

# Advanced Grant Methodology

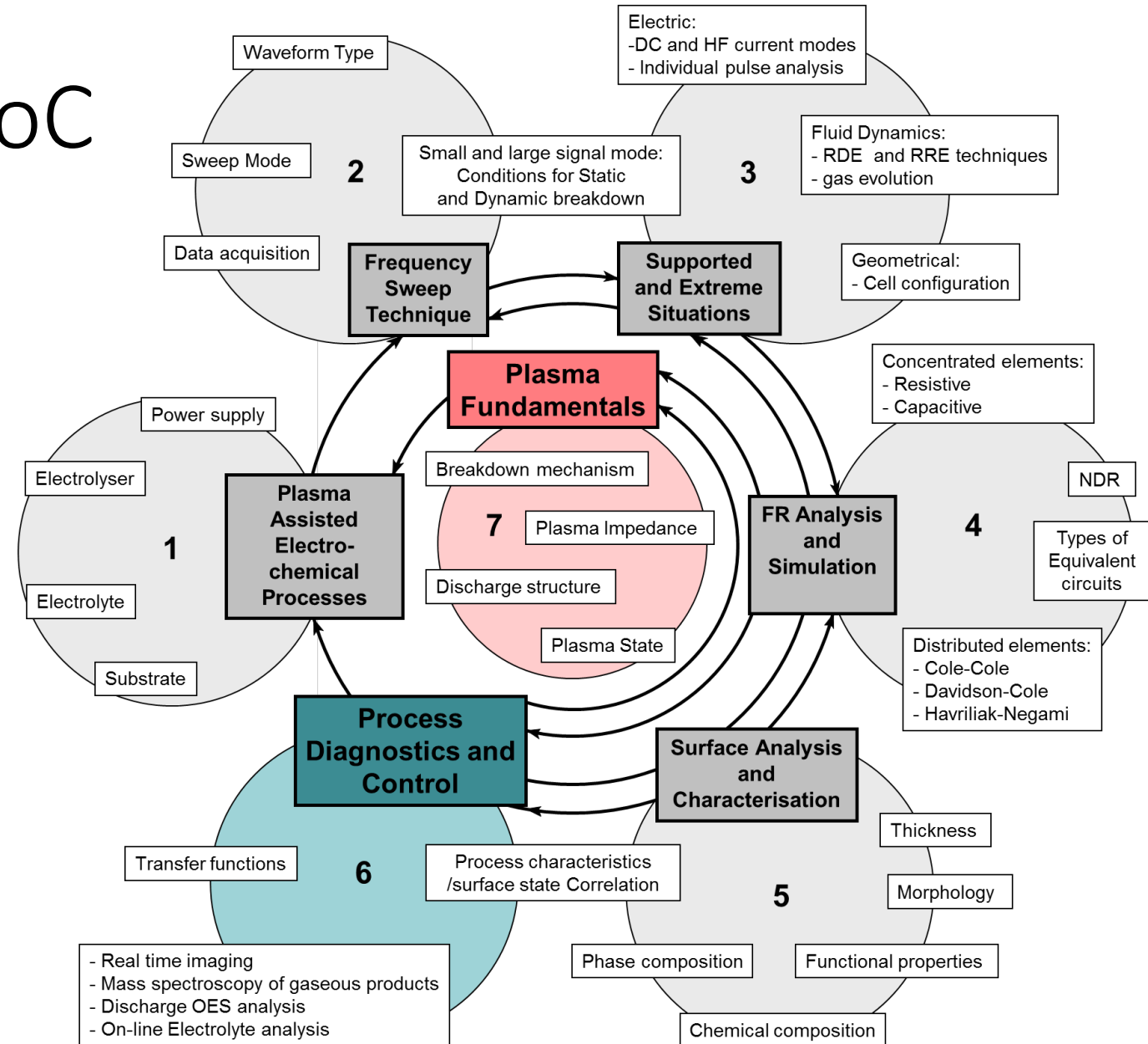


# Strand that led to PoC



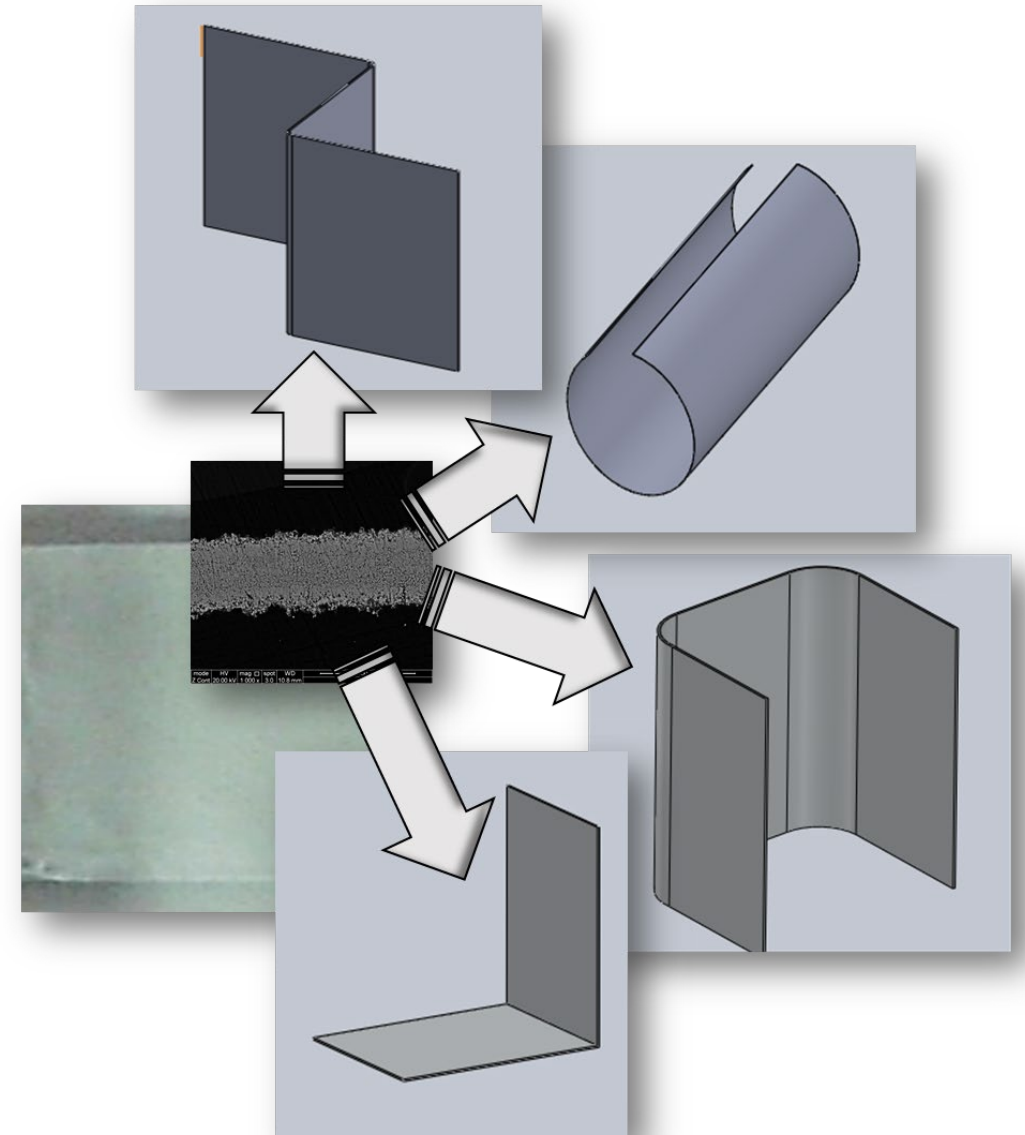
# Evolution towards PoC

- Original methodology
  - FR studies with **Plasma Fundamentals** at the core
- Required development of new methods for **Process Diagnostics & Control**
  - ⇒ **Understanding of how to form uniform ceramic coatings on complex shapes**



# PoC original proposal

- **Title: 3D CERAMIC:** 3D Ceramic Components using Plasma Assisted Electrolytic Conversion
- **Call:** ERC-PoC-2015
- **Focus – 1b. Innovation potential:**
  - Medical devices
  - MEMS
  - Controlled porosity
  - Graded structures
  - Additive manufacturing



# Initial proposal evaluation & feedback – 5

## Reviewers

<b>1. Excellence (Innovation potential)</b> Does the proposed proof of concept activity greatly help move the output of research towards the initial steps of an innovation process as defined under “evaluation criteria” in the ERC Worked Programme related to the above mentioned call?	<b>PASS</b>
<b>2. Impact</b> Does the proposal meet the PoC objectives in terms of economic and/or societal impact as defined under “evaluation criteria” in the ERC Worked Programme related to the above mentioned call?	<b>FAILED</b>
<b>3. Quality and efficiency of the implementation (Quality of the proof of concept plan)</b> Does the proposal meet the objectives related to feasibility, resources and project cost as defined under “evaluation criteria” in the ERC Worked Programme related to the above mentioned call?	<b>FAILED</b>
<b>Has the proposal been awarded a pass mark by a majority of peer reviewers on each of the three evaluation criteria?</b>	<b>NO</b>

# Selected comments – 2 Impact

- ☺ Proposal is detailed from a scientific validation perspective...
- ☺ The approach of seeking demand from the industry to produce prototype components ... is appropriate
- ☺ Applications generate societal benefits ...
- ☺ Economic benefits are appropriately identified...

- ☹ Measurements for a *competitive analysis* not identified...
- ☹ *Commercialization process ...* not fully described
- ☹ No clear indication of *market validation...*
- ☹ *IPR strategy* is given in only generic terms...
- ☹ How *outcomes will be exploited?*



# Selected comments – 3 Implementation

- ☺ Well-justified budget & highly qualified project team...
- ☺ Activities facilitate achievement of required TRL...
- ☺ Ambitious project management plan...

- ☹ Activities far from *specific application*...
- ☹ Assessment of *economic benefits* not reflected in budget
- ☹ Lack of *risk & contingency* plans...
- ☹ *External support* required in *commercial & market-related* activities

# PoC proposal that was funded

- **3D Cer-Met:** 3D Thin-Walled *Ceramic and Ceramic-Metal* Components using Electrolytic Plasma Processing
- **Call:** ERC-PoC-2018                      **Term:** Jan 2019 – Mar 2020

## Changes in Part B:

- **Section 1** The Idea
  - Clarified problem & solution
  - Focused on 3 broad applications
- **Section 2** Impact
  - Value creation process
  - Plans to assess & validate effectiveness
  - IPR strategy & knowledge transfer
  - Stakeholders (*4 Companies interested*)
- **Section 3** Workplan
  - Emphasised IPR strategy
  - Market Assessment & Application Development activities
  - Risks and mitigation plan
- **Section 4** Budget
  - IP & market assessment (*UMIP*)
  - Application Development (*Sub-contracted*)

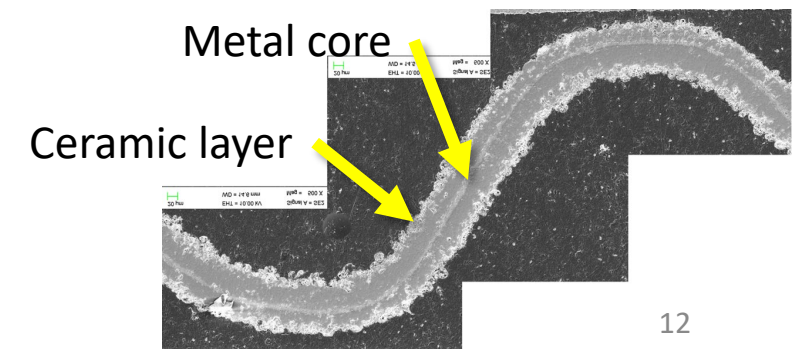
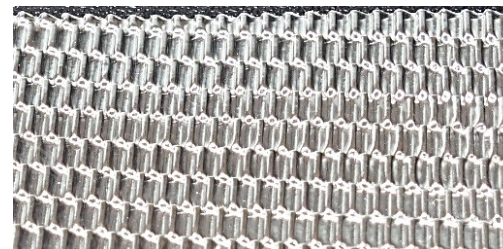
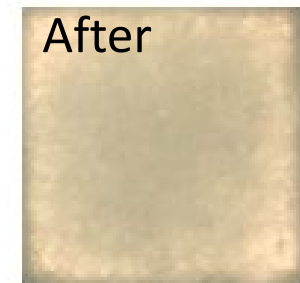
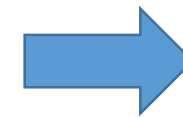
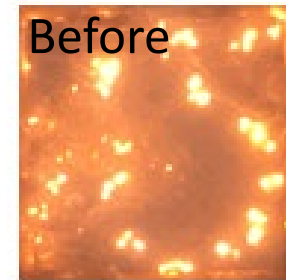
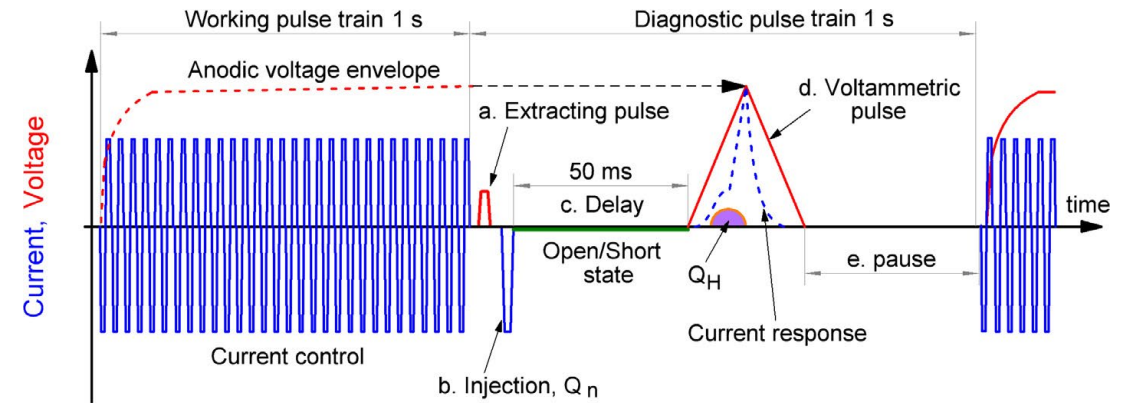
# Second evaluation & feedback – 5 Reviewers

<b>1. Excellence (Innovation potential)</b> Does the proposed proof of concept activity greatly help move the output of research towards the initial steps of a process leading to a commercial or societal innovation?	<b>PASS</b>
<b>2. Impact</b> 2.1. How well does the proposal address the identified need? 2.2. How well does the proposal address the identified need? 2.3. How well does the proposal address the identified need?	
Has the proposal been awarded a pass mark by a majority of peer reviewers on each of the three evaluation criteria?	<b>YES-S!</b>
The reviewers recommend that the proposal should be retained for funding with a grant not exceeding 149,500.00 €	

However the funding was deferred for another three months because proposal was not ranked high enough!  
So we waited anxiously....

# Research related activities within PoC project

- Continue process development:
  - New methods for in-situ process diagnostics
  - Minimise discharge destructive effect
- Focus on tribological applications:
  - Brake disks
  - High-T tribology
- Development of graded structures
  - NP incorporation
  - Solid lubricant topcoat



# PoC specific activities

## IP protection

- University of Manchester Intellectual Property department (UMIP, now Innovation Factory)
  - Initial patent search
  - Patent clinic
  - Refined patent search
- **Outcome:** Best strategy – application specific patenting

## Applications assessment

- Performed by a sub-contracted Company
  - Specialist in ceramics manufacturing
  - Identified technology providers
  - Identified potential applications
  - Assessed market value
- **Lesson to learn:** No ideal product as designers/manufacturers are unaware of new opportunities

# Following on projects and applications

- EPSRC Network+ in Digitalised Surface Manufacturing (2019-2022)
  - Addresses a broader digitalisation problem across Surface Engineering & Coatings sector
  - Engagement with stakeholders
- EPSRC 'Intelligent coatings for in-manufacture & in-service monitoring...' (CoatIN, 2020-2023)
  - In-situ methods of process control
  - Smart coatings

- **Horizon Europe EIC Transition Grant (2021)**
  - A company that supported PoC is interested
- Application driven:
  - Precision Machinery
  - Advanced Electronics
- Multi-beneficiary approach:
  - Research performer ⇒
  - Technology provider ⇒
  - Product manufacturer