

## REQUEST RFP\_2019\_#0164

### Development Partner for cBN Film Formation by PVD

**RESPONSE DUE DATE:** **October 2, 2019**

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#### Opportunity

Joint/contract development, licensing, product supply

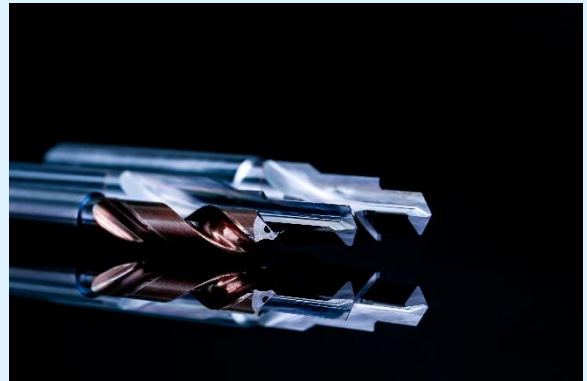
#### Timeline

Phase 1 – Basic technology verification by sample tests:  
 within 6 months

Phase 2 – Technology establishment on a lab basis:  
 within 3 years

#### Financials

Necessary development expense will be covered  
 (Details to be discussed).



#### DESCRIPTION

NineSigma, representing a **leading manufacture with multi-billion-dollar sales** (“Client”), seeks a development partner for development of physical vapor deposition (PVD) process to form cubic boron nitride (cBN). We welcome proposals from both organizations with a track record in forming cBN coatings and those with technical strength in film formation of other nitrides etc.

#### DEVELOPMENT TARGET

The goal is to develop technology that meets the following criteria, but **this is not prerequisite at present**. We welcome proposals from organizations that have film formation technology serving as a basis of development.

- cBN serving as a main component of the film
  - A peak originating from cBN is observed in a FT-IR spectrum
  - A peak originating from cBN is observed in an XRD spectrum
  - An automorphic shape of crystalline grain is observed by SEM, etc.
  - Small amounts of other elements may be contained
- High adhesion with a base material
  - Base material: Cemented carbide alloy (WC + Co), aluminum, other metals/ceramics

- Capable of forming a stable film without delamination from the base material
- Capable of forming a film with a thickness of at least 1  $\mu\text{m}$
- Nanoindentation hardness:  $\geq 40$  Gpa
  - Measurement method: nanoindentation test with indenting load of 200 mgf on more than 10 points as an averaged value
- Reproducible film formation

#### POSSIBLE APPROACHES

The Client expects film formation technologies such as the following approaches, but is also open to others:

- Sputtering
  - Sputtering using BN targets
  - Reactive sputtering using N<sub>2</sub> gas
- Ion plating
- Ion-beam-induced deposition
- Pulsed laser deposition

In addition to the above, it would be more desirable to have the following technologies for improved adhesion of BN film:

- Formation of interlayers (metals, nitrides)
- Gradient composition

## BACKGROUND

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The Client engages in the development of technology to form a film made of high-quality cBN in order to apply it to hard coatings on industrial tools, heat radiation members, and tribological members. However, a film-forming technology meeting the required quality has not been established.

In spite of efforts to form a film by chemical vapor deposition (CVD) thus far, the film is of high quality yet poor adhesion with a base material, and also compatible substrate for film deposition is limited. On the other hand, cBN has hardly been observed in film formed by PVD so far as the Client investigated.

The Client has therefore decided to make this RFP to seek a development partner in order to establish a safe and high-quality film-forming technology by PVD on a collaboration basis.

## ITEMS TO BE SUBMITTED

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Proposal may include the following items:

- Overview of the technology
- Principle of film forming technology
- Uniqueness of the technology
- Development stage: concept level, performance verified at a lab level, implemented for practical use
- Current records of the technology (Include the following to the extent possible)
  - Compounds of the formed film
  - Types of base materials
  - Film thickness
  - Deposition time
  - Nanoindentation hardness and measurement condition
  - Other data available on film quality and the measurement method
- Challenges and solutions for achieving development goals
- Sample test conditions (e.g., practicable quantity of sample, costs, period, contract terms)
- Past results (e.g., additional data to demonstrate your R&D capability such as research papers and patents)
- Profile of proposer

Please submit your proposal via [NineSights](#), the platform of NineSigma's Open Innovation community, which allows you to manage all your

proposals. Please contact the Solution Provider Help Desk [phd2@ninesigma.com](mailto:phd2@ninesigma.com) for assistance about registration and proposal submission.

## NOTES ON RESPONSE

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Proposal shall have clear points and should not include confidential information. Supplemental files may be submitted in addition to the proposal.

## RESPONSE EVALUATION

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The client will evaluate all responses with the following criteria.

- Overall scientific and technical merit
- Approach to proof of concept or performance
- Economic potential of concept
- Realism of the proposed plan (action items, timeline, roles, deliverables, cost estimation)
- Potential for proprietary position
- Respondents' capability and related experiences

## ANTICIPATED PROJECT PROCESS

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After the submission due date, the client will review all submitted proposals. NineSigma will send the review results to each proposer 6-8 weeks after the due date. The client possibly asks clarifying questions before selecting the most suitable candidates for collaboration. The client will select best candidates through evaluations. During the selection process, the client may execute NDA with selected respondents, seek further information disclosure, and discuss specific development targets or potential opportunities. The client will execute necessary agreements with the selected respondents and move to the advanced development phase. Specifics of any collaboration will be determined through consultation with the concerned parties.