Intelligence Advanced Research Projects Activity
IARPA
Creating Advantage through Research and Technology

ITHILDIN

INTELLIGENCE VALUE

The Ithildin program aimed to develop a broad toolkit of new sorbent capabilities – materials that selectively capture chemicals from the environment – for the Intelligence Community enabling improved sample collection, large area protection, and "smart" filters capabilities.

Sorbent materials in use today trap all impinging compounds within a defined molecular weight or polarity range until their capacity to uptake chemicals is exhausted. Selectivity or specificity of collected material is left to samplers, scrubbers, and filters integrated within the device. The Ithildin program developed "smart" sorbents by exploiting specific chemical interactions between the sorbent and the target chemicals (sorbates) to be trapped. Smart sorbents increase the trapping of target chemical classes while enhancing the rejection of interfering chemicals such as water or hydrocarbons. The sorbent can then be switched on or off based on various triggers: mechanical, physical, temporal, or chemical. This capability makes it possible to remotely detect indicators of target sorption.

Applications for smart sorbents include chemical sensors to be used in large venues, improved gas masks and filters, and environmental monitoring. Ithildin researchers developed radically different material platforms to capture chemicals; each approach enhanced our ability to trap chemicals differently.

Ithildin began in September 2018 and concluded in May 2020. Some key achievements include:

- biologically produced molecular organic frameworks (MOFs) that enable selective, reversible capture of target molecules with an indicator visible at distances of >1 km,
- free-standing porous silicon thin films with hierarchical pore structures to maximize sorption, and
- novel classes of self-immolative polymers as chemical triggers.

PRIME PERFORMERS

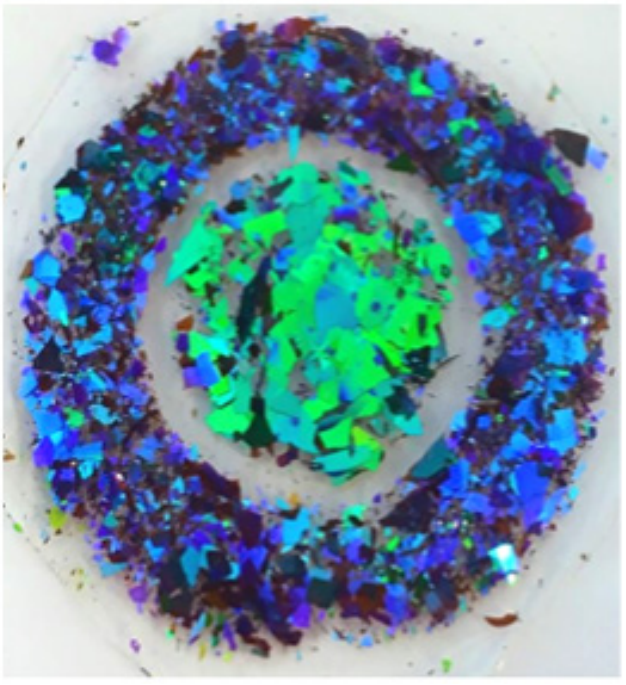
- Akita Innovations
- Leidos
- Physical Sciences Inc.
- Xilectric Inc.

TESTING AND EVALUATION PARTNERS

- Army Futures Command Combat Capabilities Development Command Chemical Biological Center
- Johns Hopkins University Applied Physics Laboratory
- Naval Research Laboratory

KEYWORDS

- Chemical detection
- Sorbents
- Materials chemistry
- Passive nanoscale technology
- Nanochemistry



Porous silicon particles engineered for color change upon chemical exposure. The different colors indicate functionalization to capture different chemical classes

ITHILDIN
SMART SORBENTS FOR SIMPLER SAMPLING

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