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ZAP Overview

Applications for ZAP's Plasma System

ZAP has developed a patented plasma hardware technology that enables revolutionary advancements in material manufacturing, synthetic mineral production, and extractive metallurgy (for precious metal) markets. The revolutionary technology generates over 20,000 degrees Kelvin and has multi-ton per hour processing capability.




I. Executive Summary

Zybek Advanced Products, Inc., (ZAP) has developed patented plasma hardware technology that enables revolutionary advancements in material manufacturing, synthetic mineral production, and extractive metallurgy (for precious metal) markets. The revolutionary technology generates over 20,000°K and has multi-ton per hour processing capability. ZAP’s technology has been proven to provide paradigm shifting results for NASA, USGS, DOE and private companies. ZAP manufactures celestial body simulant components for NASA in multi-ton quantities.

II. Background

ZAP’s plasma technology has been supported by the NASA SBIR program, DOE Cost share program as well as internal investment and research projects from private companies. Working with NASA and the USGS, ZAP provides a method to produce NASA’s lunar and celestial body simulant components for terrestrial testing prior to launch.

ZAP’s specialized NASA SBIR supported technology has vast commercial implications and direct applications to eco-friendly industrial processes. Spin off commercialization opportunities include green industrial manufacturing (glass, minerals, concrete), thermally extractive metallurgy, encapsulated nano-materials for water remediation, and synthetic mineral production.

| Company | Technology | Market Opportunities |
|---|--|--|
| <p>Zybek Advanced Products www.zybekap.com</p> <p>Research results with focus on industrialization</p> <p>SBIR projects for NASA</p> <p>\$2M DOE Cost Share Program</p> |  <p>ZAP’s patented Remotely Coupled Transferred Arc Plasma.</p> <p>Temperatures > 20,000°K</p> <p>Revolutionary process manufacturing with multi-ton per hour capability</p> | <p>NASA/USGS Celestial Simulants</p> <p>Green Industrial Manufacturing</p> <ul style="list-style-type: none"> - Glass manufacturing - Mineral melting - Concrete: stronger eco-friendly basalt fiber reinforcements <p>Thermally extractive metallurgy</p> <ul style="list-style-type: none"> - Gold, platinum, silver reclamation <p>Synthetic Materials & Minerals</p> <ul style="list-style-type: none"> - Abrasives - Catalysts - Synthetics: Ruby, Anorthosite, Sapphire <p>Water Remediation</p> |

III. Technology Overview

ZAP's plasma technology produces industrial-scale volumes of glass, synthetic minerals and agglutinates (a lunar structure not naturally occurring on Earth), manufactures novel materials, nano-materials and synthetic minerals (e.g., ruby), and thermally recovers precious metals. There are three unique features which contribute to ZAP's patented plasma system's world renowned reputation:

Power. Highest powered, remotely-coupled transferred arc process in the world ($\approx 1.2\text{MW}$ in 400in^3).

Temperature. Produces thermal energy in excess of $20,000^\circ\text{K}$.

Flexibility. Does not require an electrically conductive substrate/material to operate.

The massive power density, overwhelming thermal energy and virtually limitless material options make ZAP's system unlike any in the world.

The high power density and subsequent, temperatures are produced with electricity. The global warming potential (GWP) can be reduced for industrial processes that previously would require massive natural gas furnaces. Also, additives to reduce feedstock melting temperatures, many of which are not eco-friendly, are not necessary with ZAP's system. Today, extractive metallurgy processes to reclaim precious metals use harsh chemicals. ZAP's thermal recovery of gold and platinum may provide a green solution to some of the most environmentally egregious processes on the Earth.

ZAP's patented remotely coupled transferred arc (RCTA) plasma is built with ZAP's high technology anode and cathode torch designs. ZAP's RCTA plasma system does not require a conductive material as part of its circuit. This significantly differentiates ZAP's system from other plasma-type systems. Therefore, nonconductive material options vastly expand ZAP's plasma applicability over conventional plasma technology.

Examples of markets and direct applications for ZAP's technology include

- Green Industrial Manufacturing: Basalt, container glass, minerals, concrete additives
- Thermally extractive metallurgy: Recovery of precious metals that are encapsulated in silica/ore and cannot be recovered via chemical processes
- Synthetic Materials production for abrasive, filtration or optics industries (eg., ruby, 100% anorthosite, sapphire).
- Water Remediation: Encapsulation of volatile water remediation compounds: agglutinate encapsulated zero valent iron



IV. Successful Collaborations

ZAP's patented plasma process has successfully produced multi-tons of lunar simulant for NASA and the USGS. ZAP has executed successful SBIR programs from NASA and a \$2M cost share program from the DOE. ZAP's agglutinate and synthetic anorthosite (AN100 with 100% matching) processes are the first of their kind in the world. ZAP's extractive process reclaims gold and platinum from ore after it is processed and in the gas phase.

Commercial entities in the USA and internationally have contracted with ZAP for specialty projects and experiments. Collaborations include companies such as Owens International, Rio Tinto, 3M, Ball Aerospace and Technologies Corp., Isomatex, Evanite, NORCAT, Orbital Technologies Corp., USGS, NREL, JPL, and many NASA centers.

Industrial Manufacturing Capability



ZAP Plasma Reactor Facility,

