Northrop Grumman:

Low Temperature Co-Fired Ceramics

Licensing & Commercialization Opportunity

tradespace

Licensing Opportunity: Low Temperature Co-Fired Ceramics

Client: Northrop Grumman is a world leader in high power electronics systems and components

Available Technology: Methods for manufacturing complex LTCC components for high-power electronics use-case

Opportunity: Northrop Grumman has engaged Tradespace to approach select partners interested in building out their capability and IP protection in LTCC ceramics components for electronics in commercial markets

Key Applications

- Transmit / Receive Modules
- Capacitors
- Multilayered Ceramic Integrated Circuits (MCIC)
- Embedded Filters
- Multichip Modules
- Integrated Circuit Packaging
- High Temperature Sensors
- Fuel Cells

Opportunity Snapshot:

Focus: Low Temperature Co-Fired Ceramics

Patents: Seven Patent Families

Geographic Coverage: US, WO, JP

Average Filing Date: 2005

Maturity Level: In-Use for Fabricating High-Power Radar Modules (TRL 9)

Structure: Exclusive or Non-Exclusive License; Technology Transfer

Northrop Grumman Corporate Overview

Northrop Grumman

2020 Revenue: $36.8B

R&D Spend: $1.07B

HQ: Virginia, US

Industry: Aerospace & Defense

Corporate Website: northropgrumman.com

Northrop Grumman is a leading global aerospace and defense company with a broad portfolio of capabilities in space; manned and autonomous airborne systems, hypersonics; missile defense; weapons systems; cyber; and C4ISR.

Northrop Grumman has developed a deep capabilities in ceramics to support the complex materials needs across its product portfolio, particularly in the high-power electronics space

R&D Capabilities

Northrop Grumman invested over $1B in internal R&D in 2020. They also maintain a discrete Ceramics venture (COI Ceramics) to drive focused development and innovation in ceramics and advanced materials

Northrop Grumman IP Portfolio Snapshot

Technology Area	Patents	IP Strength
Energy	559	57%
Sensors	601	56%
Digital Computing	365	61%
Communications	438	52%
Semiconductors	271	59%
Materials	232	59%
Vehicles	237	62%
Machinery	291	56%
Chemistry	80	55%

Technology Overview: Low Temperature Co-Fired Ceramics

Patent Snapshot

Patent Families: 7

Geography: US, WO, JP

Patent Expiration Date: 6/26

Technology Snapshot

Type: Manufacturing Methods

R&D Team: Available

Technical Data: Images, design specs, filter performance, etc.

Maturity Level:

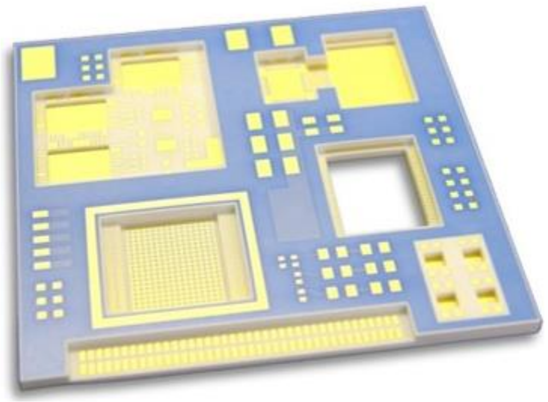
TRL 9

LTCC Methods In-Use for Fabricating High-Power Radar Modules

Technology Description

Effective, low-cost approach to manufacturing complex LTCC electronics components:

- *Multi-step lamination process*
- *Brazing metallization to attach heat sinks, lids, & pin connectors*
- *Specialized process for two-sided components*
- *Method for side printing LTCC components*
- *Improved bondability for cavities without using molds*
- *Applicable for embedded filters (bandpass filters)*

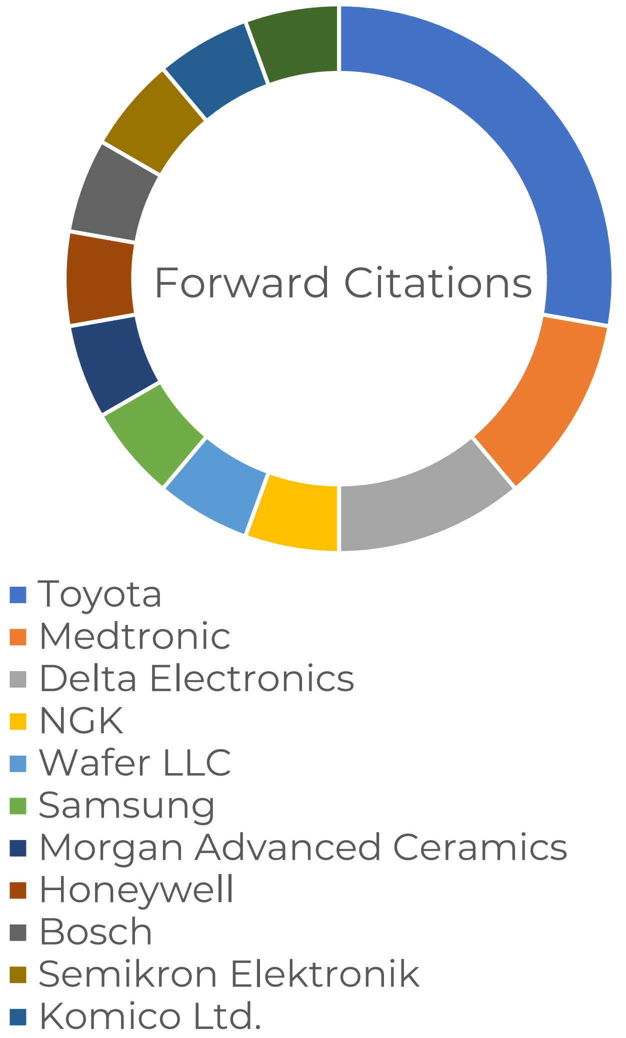


Key Technical Features & Benefits

- **Complex Packages:** *Enables fabrication of 20+ layers of 5 mil+ tape, which is required for modern packages with large numbers of complex cavities*
- **Optimized for Two-Sided Structures:** Traditional approaches are intended for one-sided structures and can cause warping when used for two-sided packages
- **Does not Require Silicon Molds:** *Replaces the need for molds, which have become increasingly expensive as package complexity has increased*
- **Improved Manufacturing:** *Enables side-printing, and fabrication of metal bases without multiple firings (which can alter resistance)*

Available Patent Families: Low Temperature Co-Fired Ceramics

Patent Number	Description	Expiration Date
US10340568B2	Voltage controlled tunable filter	1/29/2036
US8476757B2	Flip chip interconnect method and design for GaAs MMIC applications	10/15/2031
US7632451B1	Ceramic screen printing apparatus	7/21/2026
US7820490B2	Method for LTCC Circuitry	6/6/2026
US7479841B2	Transmission line to waveguide interconnect and method of forming same including a heat spreader	7/15/2025
US7416630B2	Fabrication of LTCC T/R modules with multiple cavities and an integrated ceramic ring frame	5/23/2025
US7240424B2	Method of Lamination, Low Temperature, Co-Fired Ceramic (LTCC) Material and Product Formed Thereby	4/26/2025
US7127809B2	Method of forming one or more base structures on an LTCC cofired module	1/4/2025
US7134391B2	Apparatus and method for side printing on low temperature co-fired ceramic (LTCC) substrates	11/16/2024
US7244331B1	Method of Producing an LTCC Substrate with Cavities Having improved bondability	10/7/2024
US7204900B1	Method of fabricating structures using low temperature cofired ceramics	8/5/2024
US6919125B2	Dual composition ceramic substrate for microelectronic applications	8/1/2023



Engagement Opportunities

Northrop Grumman has engaged Tradespace to approach select partners to license its portfolio of Low Temperature Co-Fired Ceramics IP

Northrop Grumman is pursuing the following partnership models:

- Patent Licensing (Exclusive & Non-Exclusive)
- Technology Transfer

Please contact Alec Sorensen, Head of Advisory & Marketplace at Tradespace, for further information regarding the opportunity

Contact:

Alec Sorensen
Head of Advisory & Marketplace
alec@tradespace.io
804.836.7938