

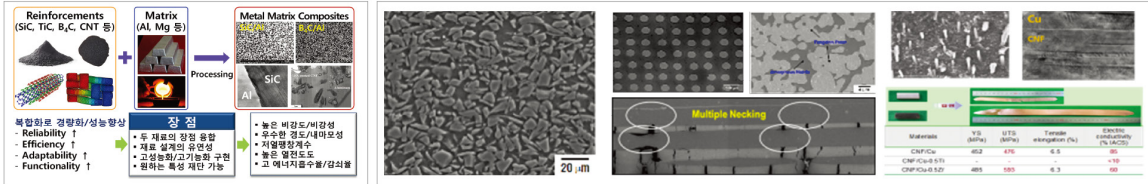
경량 알루미늄/마그네슘 금속복합재료 기술

Lightweight Al/Mg based Metal Matrix Composites

TRL3

기술내용

- 강화재(세라믹, 탄소 소재 등)와 기지금속(Al, Mg 소재 등)이 가지는 독자적이고 우수한 특성을 조합하고, 이들의 구조를 제어함으로써 경량화와 비강도, 비강성, 내마모 등 기계적 성능 향상을 동시에 달성할 수 있는 소재
- 독자기술인 액상가압공정을 적용하여 기존 용탕 단조 공정보다 저압에서 성형 가능

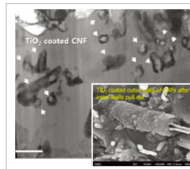


입자강화 금속복합소재

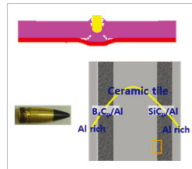
섬유강화 비정질 복합소재

나노카본 금속복합소재

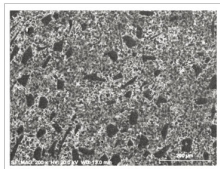
- 우수한 기계적 특성, 경량화, near-net 형상 부품 제조 가능
- 경량/고탄성 금속복합소재
 - 나노탄소-탄화물 강화 알루미늄 복합재
 - * 강성: > 120GPa, 압축강도: > 800MPa
 - 나노탄소-탄화물 강화 마그네슘 복합재
- 내충격/고탄성 방탄 금속복합소재
 - 금속복합소재에 비산화물계 세라믹 타일삽입한 경량 방탄복합재
- 경량 열안정성 금속복합재료 기술 (인공위성/광학부품)



나노카본 금속복합소재 (Al, Mg)



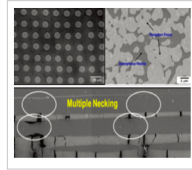
세라믹 타일 삽입 내충격/고탄성 금속 복합소재



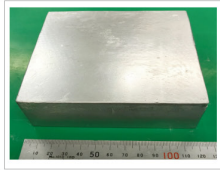
고체적용 SiC/Al 금속 복합소재



열안정성 Al 복합소재



비정질 금속복합소재



타일삽입 금속복합소재 방탄모듈 (120 x 120 x 40mm)

우수성

- 기존소재대비 50%이상 경량화, 우수한 내마모/고온 구조강도 특성
- 저비용, 대형 시제 제작 가능
- 대형 경량방탄소재로 다중피탄 방호성능 향상
- Al기 경량 금속복합소재 주요 특성
 - 밀도 : 2.58 g/cm³ (B₄C/Al) - Fe계 소재 대비 60%이상 경량화
 - 압축강도 (B₄C/Al) : 1422 MPa (문헌상 최고수치)
 - 열팽창계수(SiC/Al) : 7.56 ppm/°C (세계최고수준 : 8 ppm/°C - CPS tech.)
- [특허] KR10-1737218 탄화규소 타일/알루미늄 하이브리드 복합재 및 이의 제조방법

보유기술

- 경량 금속복합소재 제조기술
 - 기지, 강화재 설계기술
 - 제조 금속복합소재 열처리 기술
 - 강화재 체적을 제어기술
 - 금속복합소재 평가기술
- 내충격/고탄성 대형 방탄모듈 제조기술
- 열안정성 금속복합소재 제조기술

사업성

- 금속복합소재가 신금속 소재를 일정 부분 대체한다고 보았을 때 신금속 시장의 연평균 성장세가 수송기기, 전기전자/방열, 항공 및 방위산업에서 매년 10~15% 이상으로, 2020년 총 5억 9천만 달러 규모의 세계시장을 견인
- 자동차 동력전달장치용 경량 금속복합소재의 독자기술 확보
- 항공/우주용 금속복합소재, 방탄/장갑소재, 유도 무기등에 직접활용가능

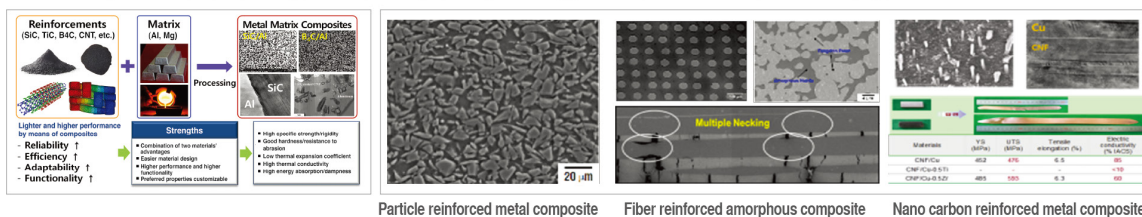


Lightweight Al/Mg based Metal Matrix Composites

TRL3

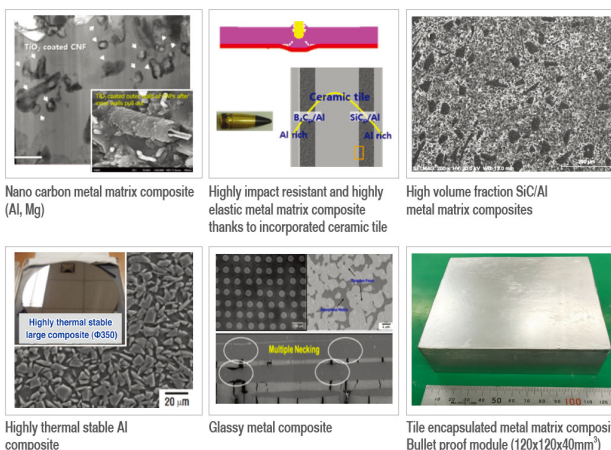
Technology Overview

- These composites combine the unique and good properties of reinforcement (ceramic, carbon) and matrix metal (Al, Mg, Fe) control their structure to provide improved mechanical properties such as elastic modulus, specific strength, specific rigidity, and abrasion resistance.
- MMCs can be produced by liquid pressing process (KIMS's proprietary technology) at lower pressure as compared with forging process.



Particle reinforced metal composite Fiber reinforced amorphous composite Nano carbon reinforced metal composite

- Possible to fabricate lightweight, near-net shaped parts having good mechanical properties
- Lightweight and highly elastic metal matrix composites
 - Nano-carbon carbide reinforced aluminum composites
 - * Rigidity: > 120 GPa, compressive strength: > 800 MPa
 - Nano-carbon carbide reinforced Mg composites
- Impact resistant / bulletproof metal matrix composites
 - Lightweight bullet proof composite where non-oxide base ceramic tiles are incorporated in metal matrix composite
- Lightweight thermal safe metal matrix composite (for satellite and optical parts)



Highlights and Strengths

- 50% or more weight reduction as compared to steel, superior wear resistance/high temp. property
- Low cost, capable for producing pilot scale specimen
- Lightweight bulletproof material with multi-hit capability
- Lightweight Al based metal matrix composite
 - Density: 2.58 g/cm³ (B₄C/Al) – Over 60% lighter than Fe base material
 - Compressive strength (B₄C/Al) : 1422 MPa (highest level ever in literature)
 - Thermal expansion co-efficient (SiC/Al) : 7.56 ppm/°C (World's top level: 8 ppm/°C – CPS tech.)
- [Patent] KR10-1737218 SILICON CARBIDE TILE/ALUMINIUM HYBRIDE COMPOSITES AND METHOD FOR MANUFACTURING THEREOF

KIMS's technologies

- Technology to fabricate lightweight metal matrix composites
 - Design of matrix, reinforcement
 - Heat treatment of metal matrix composites
 - Control of reinforcement's volume fraction
 - Evaluation of metal matrix composites
- Technology to fabricate large sized bulletproof modules having high impact resistance and high elasticity
- Technology to fabricate thermally stable metal matrix composites

Business Cases

- Assuming that metal matrix composites replace some of new metal, the new metal market will grow by 10 to 15 percent in such sectors as transport, electricity/electronics, heat releasing, aerospace and defense and will lead the global market that will be worth \$590 million by 2020
- Proprietary lightweight metal matrix composites for vehicle transmission
- Applicable to aerospace, defense (bullet proof/armored weapons), guided weapon systems

