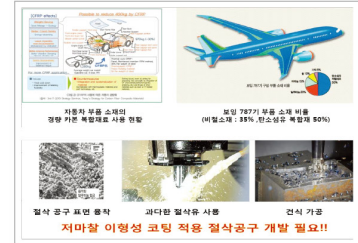


비철 및 복합소재 가공용 공구의 수명향상을 위한 고경도 이형막 코팅 기술

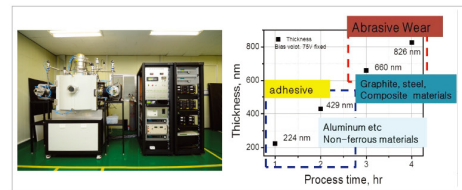
High hardness and anti-stiction coating for life time enhancement in nonferrous metals cutting tools **TRL5**

기술내용

- 산업트렌드가 제품의 경량화와 정밀화 요구에 따라 비철 분야 사용 증대 및 이에 따른 비철 가공용 절삭 공구 수요 증가
 - 자동차 산업, IT 산업(알루미늄, 티타늄), 항공산업(복합소재)
- 화학적 안정성이 우수하며 내용착 특성이 우수한 무수소 DLC를 이용한 비철 가공용 공구 적용 연구

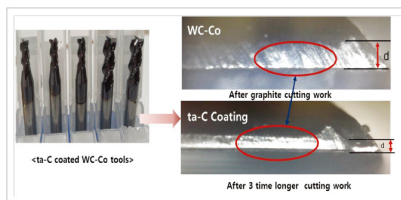


- 절삭 소재 별 마멸 유형에 따른 두께 분류 Map 작성 연구
 - 비철 가공용 절삭공구 (Graphite 가공용)
 - 철계 가공용 절삭공구 (Steel 가공용)
 - 마멸 (wear) 유형에 따른 코팅막 물성제어
 - 비철계 가공용 절삭공구 (Carbon composite)
 - ⇒ 용착마멸: 알루미늄 등 비철소재(두께: 0.2~0.4 um)
 - ⇒ 연삭마멸: 그래파이트, 카본복합재(두께: 0.6~1.0 um)

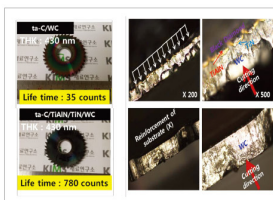


우수성

- Graphite 가공용 무수소 DLC 코팅: 비코팅 공구에 비해 수명 3~5배 증가 및 모재 피해 감소
- Steel 가공용 무수소 DLC 코팅: 기존 대비 수명 2.5 배 증가(기존 300회→780회)
- Carbon composite 가공용 무수소 DLC 코팅: 비철계 기존 질화물계 코팅 공구 대비 수명 2배 증가 확인



Graphite 가공용



Steel 가공용



Carbon composite 가공용

- [특허] KR10-2016-0079406 ta-C 층을 포함하는 모재

사업성

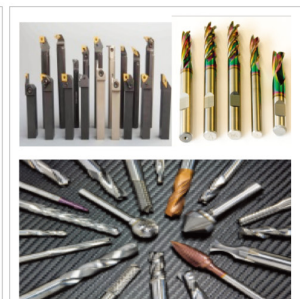
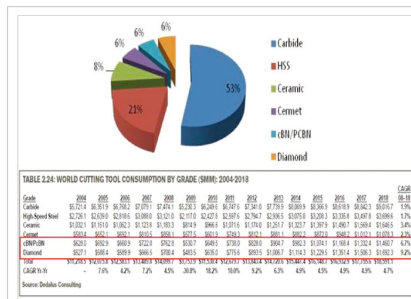
- 비철 가공용 공구 시장 연평균 성장률 6.7 %
- ta-C 공구 적용 시 15.9 % (2.331\$MM) 대체 시장 생성

기대 효과

- 현재 수소 없는 DLC(ta-C) coating에 대한 기술 선도
- 비철 및 복합소재 공구 코팅 분야 신규 시장 개척

활용 분야

- 비철 및 복합소재 가공용 공구의 이형성 코팅 기술



High Hardness and Anti-stiction Coating for Life-Time Enhancement in Nonferrous Metal Cutting Tools

TRL5

Technology Overview

- Increasing demand in industry for lighter and more precise products. Resulting in greater use of non-ferrous metal and greater demand for tools for cutting non-ferrous metal.
 - Automotive, IT (aluminum, titanium), aerospace (composite)
- This technology pertains to fabricating tools for non-ferrous metal using hydrogen-free DLC having good chemical stability and exceptional anti-adhesion.

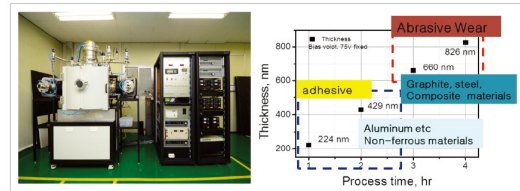
Light carbon-composite application on automobile parts

Proportion of part materials of Boeing-787 (nonferrous: 35%, carbon fiber composite: 50%)

surface contamination by cutting tool fusion Over-consumption of cooling oil dry process

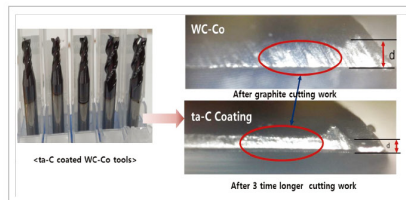
Needs for cutting tool coated by anti-stiction materials with low friction

- Thickness classification according to the wear type of material to be cut
 - Cutting tools for non-ferrous metal (graphite machining)
 - Cutting tools for ferrous metal (steel machining)
 - Control of coated film according to wear type
 - Cutting tools for non-ferrous metal (carbon composite machining)
 - ⇒ Adhesive wear: Non-ferrous metal including aluminum (thickness: 0.2-0.4 um)
 - ⇒ Abrasive wear: Graphite, carbon composite (thickness: 0.6-1.0 um)

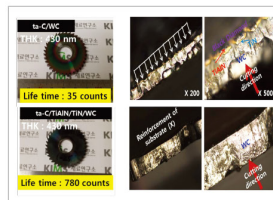


Highlights and Strengths

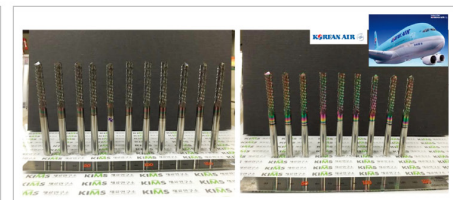
- 1) Hydrogen-free DLC coating for graphite machining: 3 to 5 times longer life than non-coated tools; less damage to the matrix
- 2) Hydrogen-free DLC coating for steel machining: 2.5 times longer life (300 runs vs. 780)
- 3) Hydrogen-free DLC coating for carbon composite machining: 2 times longer life compared to existing non-ferrous, nitride base coated tools



For graphite machining



For steel machining



[Patent] KR10-2016-0079406 A MATERIAL COMPRISING TA-C LAYER

Business Cases

- Market for non-ferrous metal tools: Growing 6.7% per annum
- An alternative market of 15.9 percent (\$2.31 B) when ta-C tools included

Benefits

- Currently, leading hydrogen-free DLC (ta-C) coating
- New market development for coating of non-ferrous/composite metal tools

Applications

- Anti-adhesion coating of tools for machining non-ferrous and composite metal

