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Cost saving in composite materials is very important. Therefore fly ash particles, which are a waste product of coal combustion, can be used as reinforcement in aluminum matrix composite materials. Aluminum matrix composite materials (AMC) fabricated from A360 and 443 aluminum alloys and Tunbilek,Yatagan fly ashes were used as reinforcement with volume fractions 5%, 10%, 15%, 20%. Stir mixing and casting process were used for the production of fly ash containing aluminum-matrix composites (AMC's). Specially designed and ceramic covered mixers were used for stirring of melted aluminum alloy at 750, 850, 950°C temperatures and 400, 560, 750 rpm rotation rates. It has been observed that, with applied production process, maximum 20% (volume fraction) fly ash can be added to aluminum alloy matrix. Referring to the experimental data, optimum properties were achieved at 850°C stirring temperature and 560 rpm mixer rotation rates.
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Production of austempered ductile iron gears for transmission cases

Produktion von Getriebe-Zahnrädern aus ausgetemperten duktilen Eisen

- Ahmet Sagin and Ahmet Topuz

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Abstract

The investigations presented in this contribution were targeted to replace a gear group made up of SAE 8620 steel in army jeeps with microstructural controlled austempered ductile iron, in order to reduce the manufacturing steps. Furthermore, the vibrations were also expected to decrease, due to the application of austempered ductile iron. The fatigue resistance of unalloyed and Ni alloyed austempered ductile iron have been investigated to see if some improvement as compared to steels with cementite could be achieved. The effect of the austenization heat treatment on the fatigue resistance was studied in metallographic investigations and it turned out that the alloying elements Cu, Ni and Mo have a beneficial effect. For economical reasons, the gears were fabricated of nodular iron containing 3.98% C, 1.89% Si, 0.269% Mn and 0.028% P. Considering the fatigue resistance, a Ni alloyed material with 3.66% C, about 1.81% Si, 0.134% Mn, 0.031% P and 1.51% Ni was chosen. The roundness of the graphites was about 93–100% and 80–85%. The gears were at first produced by austenization at 900°C for 3 hours and then by austempering at 235°C for 2.5 hours. The fatigue tests were performed at the maximum stresses to be expected.

Kurzfassung

Ziel der Untersuchungen, deren Ergebnisse in diesem Beitrag zusammengefasst sind, war es, eine Gruppe von Zahnrädern aus dem Stahl SAE 8620 im Getriebe eines Armee-

Fahrzeuges mit solchen aus ausgetemperten Eisen zu ersetzen, um die Zahl der fertigungsschritte zu reduzieren. Darüber hinaus wurde erwartet, dass sich die Vibrationen mit der Verwendung dieses Werkstoffes verringern ließen. Es wurde die Ermüdungsfestigkeit von unlegiertem und mit Nickel legiertem Eisen geprüft, um Verbesserungen gegenüber Stählen mit hohem Zementitgehalt zu erzielen. Bei der metallografischen Untersuchung der Effekte der Austenitisierung auf die Verbesserung der Schwingfestigkeit stellte sich heraus, dass sich die Elemente Kupfer, Nickel und Molybden positiv auswirken. Aus wirtschaftlichen Gründen kam daher primär unlegierten Gusseisen mit 3,98% C, 1,89% Si, 0,269% Mn und 0,028% P zum Einsatz. Unter Berücksichtigung der Ermüdungsfestigkeit wurde jedoch eine mit 1,51% Nickel legierte Variante mit 3,66% C, etwa 1,81% Si, 0,134% Mn und 0,031% P gewählt. Die Rundheit des Grafits betrug 93–100% und 80–85%. Die Zahnräder wurden mit einer dreistündigen Austenitisierung bei 900°C und einem zweieinhalbstündigen Austempern bei 235°C produziert.

Dr. Ahmet Sagin, born 1968, graduated 1991 at the Metallurgy Engineering Department of the Technical University of Yıldız in Istanbul. In 1994 he received his Ms degree and 1999 his PhD at the same place. He has been working in this department as a research engineer for 13 years.

Prof. Ahmet Topuz received his PhD degree in 1983 at the Technical University of Yıldız in Istanbul and his Professor degree in 1988. From 1984 until 2004, he was head of the Materials Science Branch of the University. He was also Head of the Metallurgy and Materials Science Department until 1992. From 1992 to 2001, he was Dean of the Chemical and Metallurgical Faculty.

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Nitriding of a 42CrMo4 and a 34CrAlNi7 steel in a fluidized bed furnace

Nitrieren der Stähle 42CrMo4 und 34CrAlNi7 in einem Fluidbettofen

- Zekeriya Cömert , Polat Topuz , Ahmet Sagin and Ahmet Topuz

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Abstract

This contribution presents a study about the design and the manufacturing of a fluidized bed furnace. Nitriding was carried out by using fluidized bed furnace and optimum process parameters were determined for nitriding. In these experiments DIN 7225 and DIN 8550 steels were used, and as a first step two types of steel were hardened and tempered. Nitriding was carried out by using N_2 + NH_3 at 520°C and 570°C. Nitriding times were selected as 3, 6 and 12 hours. The thickness of nitride layers varied from 6.1 to 39.73 mm. The hardness of nitride layers varied from 605 to 1114 HV. The tensile strength of the specimens were found between 618 and 1162 MPa. Their yield strength values varied from 479 to 939 MPa and their impact resistance values were found between 2.25 J/cm^2 and 84 J/cm^2. Effect of nitriding on the mechanical properties of the specimens are discussed.

Abstract

Im vorliegenden Beitrag wird die Konstruktion und die Fertigung eines Fluidbettofens vorgestellt. Das Nitrieren erfolgte mittels dieses Ofens, wofür die optimalen Prozessparameter bestimmt wurden. Für die experimentellen Untersuchungen wurden Stähle nach DIN7225 und DIN8550 verwendet. Als Erstes wurden diese Werkstoffe gehärtet und angelassen. Das Nitrieren wurde mittels N_2 + NH_3 bei 520°C und bei 570°C über 3, 6 und 12 Stunden durchgeführt. Die Dicke der Nitridschichten lag zwischen 6,1 und 39,73 mm. Die Härte der Nirtidschichten variierte zwischen 605 und 1114 HV. Es wurde eine Zugfestigkeit der Proben zwischen 618 und 1162 MPa bestimmt, während die Streckgrenze zwischen 479 und 939 MPa und die Kerbschlagzähigkeit zwischen 2,25 J/cm^2 und 84 J/cm^2 lag. Darüber hinaus wird die Wirkung des Nitrierens auf die mechanischen Eigenschaften der Proben diskutiert.

Zekeriya Cömert studied in metallurgical engineering department of Yildiz Technical University from 1995 to 1999 and achieved his master degree in 2002 in Materials Science. He is currently working for his PhD at the Yildiz Technical University.

Polat Topuz studied in the Faculty of Technical Education of Marmara University from 1995 to 1999, and at the Institute for Graduate Studies in Pure and Applied Sciences of the Marmara University from 2000 to 2003. He began his PhD studies in 2003 at the same university.

Ass. Prof. Dr. Ahmet Sagin, born 1968, studied from 1987 to 1994 at the Metallurgical Engineering Department of Yildiz Technical University, and completed in 1999 his PhD study about the investigation of fatigue behaviour of austempered ductile iron gear box and its production with the doctoral degree at the same university. Areas of interest are mechanical testing of materials, mechanical metallurgy and heat treatments of ductile iron and steels.

Prof. Dr. Ahmet Topuz received his PhD at the Yildiz Technical University in Materials Science. Since 1988 he is Professor for Materials Science at the Yildiz Technical University. From 1984 to 2004 he is heading the Materials Science Branch at Yildiz Technical University. He main scientific field is the mechanical and non destructive testing of materials.

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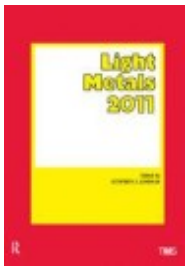

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Production of Al-Ti-C Grain Refiners with the Addition of Elemental Carbon and K_2TiF_6

- Fatih Toptan,
- Isil Kerti,
- Sibel Daglilar,
- Ahmet Sagin,
- Omer F. Karadeniz &
- Aysin Ambarkutuk

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Abstract

Al−Ti−B grain refiners are widely used as aluminum grain refiners. Despite the problems in application, Al−Ti−C refiners have an increasing demand in recent years. In the present work, Al-Ti-C grain refiners with different Ti:C ratios were produced by in-situ method with the addition of elemental carbon into the Al-Ti master alloy (master alloy method) and the addition of K_2TiF_6 and elemental carbon powder mixture into the commercially pure aluminum (flux method). The effects of production method and Ti:C ratio on the grain refinement process were investigated using Alcoa Cold finger Test and so optimum conditions were determined. The best performance was accomplished with the refiner produced at 1300°C with the master alloy method.

Keywords

- **Aluminum**
- **Al-Ti-C Grain Refiners**
- **Elemental Carbon**
- **K_2TiF_6**

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Effect of particle size particle surface modification pressing pressure and sintering temperature on microstructure and mechanical properties P/M Al-B $_4$C composites

Toptan, F., Kerti, I., Daglilar, S., Sagin, A., Hacioglu, T.

TMS Annual Meeting, 2011, 1, pp. 491–498

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In the present work, effect of particle size, particle surface modification, pressing pressure and sintering temperature on microstructure and mechanical properties were investigated at B4C reinforced aluminium matrix composites produced with powder metallurgical route. In order to improve the matrix/reinforcement interface bonding, prior to processing, electroless nickel coating and partial oxidation were performed on the B4C particles. Three different B4C particle sizes (10, 32 and 66 μm) were used and three different sintering temperatures (550, 590 and 630°C) were performed for three different sintering time (2, 4 and 6 h) to produce the composites. Microstructures were characterised by using optical microscope and field emission gun SEM (FEG-SEM) equipped with energy dispersive analysis (EDS). Compression strength, hardness, density and porosity values were determined. After microstructural and mechanical investigations, is has seen that optimum values were obtained from fine particles modified with electroless nickel coating, sintered at 630°C for 6 hours.

Book Chapter

Microstructural Properties and Wear Behaviour of AlSi9Mg Matrix B_{4Cp} Reinforced Composites

Toptan, F., Kerti, I., Sagin, A., ...Daglilar, S., Yuksel, F.

Supplemental Proceedings: Materials Fabrication, Properties, Characterization, and Modeling, 2011, 2, pp. 837–842

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In the present work, AlSi9Mg alloy matrix composites reinforced with 10, 15 and 20% (wt.) B4CP were produced by casting route at 850 °C. Titanium-containing flux (K2T1F6) was used to overcome the wetting problem between B4C and liquid aluminium metal. The microstructure of matrix/reinforcement interfaces were investigated with SEM studies. The reaction layer was also characterized with EDS analysis and X-ray mapping. It was found from the microstructural observations by high resolution field emission gun SEM (FEGSEM) that the wetting improved by the formation of very thin (80-180 nm in thickness) TiC and T1B2 reaction layers. The samples were subjected to pin-on-disc wear tests against AISI 4140 pin under dry sliding conditions. The worn surface was studied through SEM and EDS analysis. It has seen that, wear resistance increased as particle volume fraction increased.

Conference Paper

Microstructural properties and wear behaviour of AlSi9Mg matrix B $_4C_p$ reinforced composites

Toptan, F., Kerti, I., Sagin, A., ...Daglilar, S., Yuksel, F.

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- Conference Paper

  Microstructural properties and wear behaviour of AlSi9Mg matrix B_4C_p reinforced composites

  Toptan, F., Kerti, I., Sagin, A., ...Daglilar, S., Yuksel, F.

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In the present work, AlSi9Mg alloy matrix composites reinforced with 10, 15 and 20% (wt.) B4Cp were produced by casting route at 850 °C. Titanium-containing flux (K2TiF6) was used to overcome the wetting problem between B4C and liquid aluminium metal. The microstructure of matrix/reinforcement interfaces were investigated with SEM studies. The reaction layer was also characterized with EDS analysis and X-ray mapping. It was found from the microstructural observations by high resolution field emission gun SEM (FEG-SEM) that the wetting improved by the formation of very thin (80-180 nm in thickness) TiC and TiB2 reaction layers. The samples were subjected to pin-on-disc wear tests against AISI 4140 pin under dry sliding conditions. The worn surface was studied through SEM and EDS analysis. It has seen that, wear resistance increased as particle volume fraction increased.

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Citations

- Book Chapter

Microstructural Properties and Wear Behaviour of AlSi9Mg Matrix B^{4Cp} Reinforced Composites

Toptan, F., Kerti, I., Sagin, A., ...Daglilar, S., Yuksel, F.

Supplemental Proceedings: Materials Fabrication, Properties, Characterization, and Modeling, 2011, 2, pp. 837–842

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Citations

- Conference Paper

  Effect of particle size particle surface modification pressing pressure and sintering temperature on microstructure and mechanical properties P/M Al-B $_4$C composites

  Toptan, F., Kerti, I., Daglilar, S., Sagin, A., Hacioglu, T.

  TMS Annual Meeting, 2011, 1, pp. 491–498

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  In the present work, effect of particle size, particle surface modification, pressing pressure and sintering temperature on microstructure and mechanical properties were investigated at B4C reinforced aluminium matrix composites produced with powder metallurgical route. In order to improve the matrix/reinforcement interface bonding, prior to processing, electroless nickel coating and partial oxidation were performed on the B4C particles. Three different B4C particle sizes (10, 32 and 66 μm) were used and three different sintering temperatures (550, 590 and 630°C) were performed for three different sintering time (2, 4 and 6 h) to produce the composites. Microstructures were characterised by using optical microscope and field emission gun SEM (FEG-SEM) equipped with energy dispersive analysis (EDS). Compression strength, hardness, density and porosity values were determined. After microstructural and mechanical investigations, is has seen that optimum values were obtained from fine particles modified with electroless nickel coating, sintered at 630°C for 6 hours.

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- Conference Paper

  Production of Al-Ti-C grain refiners with the addition of elemental carbon and K_2TiF_6

  Toptan, F., Kerti, I., Daglilar, S., ...Karadeniz, O.F., Ambarkutuk, A.

  TMS Light Metals, 2011, pp. 821–825

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Cömert, Z., Topuz, P., Sagin, A., Topuz, A.

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Kolukisa, S., Topuz, A., Sagin, A.

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