

# Single strand rod feeder for Optifine

Optifine is a potent TiBAl grain refiner typically requiring half of less of the addition required when using conventional grain refiners. Fed in rod form, this necessitates greater control of feed rate which has been achieved in a new rod feeding machine. **By Michael Bryant, Marketing Manager, MQP**

Optifine is a highly potent TiBAl grain refiner marketed by UK group MQP. It has been shown in industrial trials that targeted levels of grain refinement in a range of aluminium alloys can be achieved at far lower addition rates with Optifine than with conventional TiBAl grain refiners.

In Opticast trials a number of 5Ti/1B master alloys from two commercial producers were obtained from an industrial cast house and compared with two 3Ti/1B OptiFine grain refiners (Fig 1).

It is clear that the efficiency of the two Optifine grain refiners is markedly higher. About 0.3kg/t of the Optifine grain refiners will create a grain size of 150µm. At least twice that much is needed of the most efficient of the other grain refiners. In the worst case, TiBAl alloy number 1 requires at least six times more to obtain the same grain size. More recently in full casthouse production at Hulamin (1) the Opticast system (2) has been successfully applied as a production tool as a means of decreasing master alloy additions in a controlled way. The aim was to optimise each cast by adjusting the master alloy addition rate so that a minimum amount of grain refiner was added without risk of cracking. The reductions in addition levels achieved with Optifine in three different alloy series are shown in Table 1.

In commercial practice today addition rates from 0.5kg/t up to 1.0kg/t are still routinely used with conventional TiBAl grain refiners to obtain the level of grain refining needed to avoid ingot cracking in many alloys. Optifine has however been able to achieve the required result with much lower addition rates down to 0.1kg/t or even less.

TiBAl grain refiners in the form of 9.5-9.7mm rod in coils, are found throughout the aluminium industry, added to molten aluminium alloys by means of specialised rod feeding machines. These machines are designed to operate at a range of speeds which will deliver TiBAl rod at a rate as low as 10cm per minute (equivalent to an addition rate of 0.24kg/t for a 5t/hour metal flow) and up to a maximum of 600cm per minute for much higher metal flow. The accuracy of addition rates using these machines is normally quoted as +/-3%.

## Greater precision

Since Optifine has been proven to be effective at much lower addition rates

Fig 1 Opticast crucible tests with alloy AA1050. Master alloys 1 to 8 are 5Ti1BAl commercial master alloys. OF1 and OF2 are Optifine alloys

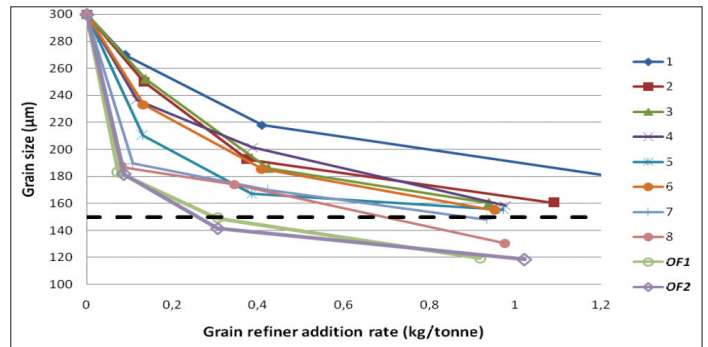
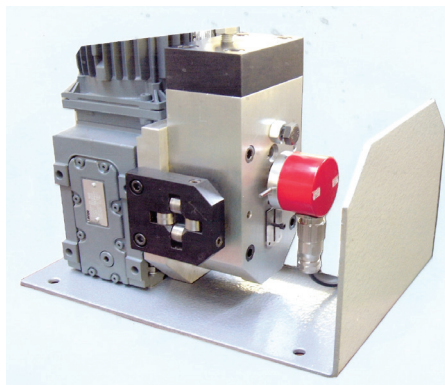


Fig 2 Prototype Optifeeder rod feeding machine



than conventional TiBAl rod there is a need for a rod feeding machine which will deliver Optifine rod at low speeds and at greater accuracy than conventional rod feeding machines.

MQP has in partnership with a vastly experienced UK producer of commercial rod feeders, commissioned a specially designed rod feeder. This will deliver Optifine rod at a rate as low as 4.0cm/min up to a maximum of 80cm/min with an accuracy of +/- 0.5%. Other speed ranges can be provided on request.

## Optifeeder

The single strand rod feeder, which will be marketed by MQP as Optifeeder, has a shaft encoder fitted to the geared motor to provide a speed reference. It also has a second shaft encoder on the drive top feed roll to provide the actual rod speed (Fig 2).

The Optifeeder control panel provides speed control using an inverter configured for encoder feedback. An Allen Bradley plc incorporated with a touch screen HMI display for operator convenience. A high-speed counter within the plc provides an independent display of actual rod feed rate.

MQP believes that when Optifine is used in conjunction with the Opticast system to

Alloy	No of casts	Av addition drop (%)
<b>AA3000-series</b>		
Alloy 1	2	74
<b>AA6000-series</b>		
Alloy 2	2	62
Alloy 3	2	89
<b>AA5000-series</b>		
Alloy 4	13	65
Alloy 5	12	56
Alloy 6	1	62
Alloy 7	1	76

Table 1 Reductions in addition levels achieved with Optifine in three different alloy series

optimise the addition level and thereby minimise the cost of grain refinement, it is especially important to know precisely the amount of rod being added.

The Optifeeder Rod Feeder machine, due to its mode of rod speed measurement, offers an accurate rod addition as well as the facility to monitor and store information relating to all Optifine treated casts. ■

## References

- (1) Rein Vainik, Gus Hornsby John Courtenay and Michael Bryant 'Optifine potent grain refiner reduces risk of cracked ingots and billet', Aluminium International Today, March/ April 2010, pp24 & 25
- (2) L Backerud and R Vainik, 'Method for Optimized Aluminum Grain Refinement', Light Metals 2001, 951-954.

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