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A process for pelletizing lead- and potash glass batches

Von Bo K. W. Simmingsköld und V. Carbol, Växjö (Schweden)

(Mitteilung aus dem Glasforskningsinstitutet, Växjö (Schweden))

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The use of pelletized glass batch has many advantages, compared with loose batch: Segregation and dusting is eliminated during handling and charging. Thus, the poisoning hazard from red lead and other components by charging is reduced and less corrosion occurs in the furnace. By lead-glass melting the losses of lead are reduced and the homogeneity of the melt is improved. The pelletized batch has very good floating properties which faciliates manual charging and also permits charging by machine without complicated equipment. The weight by volume of pelletized batch is higher than in the case of loose batch. By pot melting two charges instead of three are sufficient. The time to obtain batch free melt can be reduced up to about 25 % by melting 30 % lead crystal glass.

A new process, applied for patent, for continuous production of practically water free pellets has been developed. The process works without addition of any binding agent influencing the composition of the glass or giving melting or discolouring troubles. The process gives directly dry pellets and thus the problem of softening by normal drying of pellets is eliminated.

The process has been used in practice and works very well in batches with potash:soda ash ratio 1 or higher.

Procédé de granulation de mélanges vitrifiables pour verres au plomb et à la potasse

L'utilisation d'un mélange vitrifiable granulé offre maints avantages par rapport à un mélange libre: La ségrégation et la formation de poussières sont éliminées au cours de la manipulation et de l'enfournement. Le danger d'empoisonnement par le minium de plomb et d'autres composants lors de l'enfournement est donc réduit et la corrosion du four diminuée. Au cours de la fusion de verre au plomb, les pertes en plomb sont réduites et l'homogénéité du mélange en est améliorée. Le mélange vitrifiable granulé possède d'excellentes propriétés de flottaison qui facilitent l'enfournement manuel et permettent également l'enfournement mécanique sans équipment complexe. Le rapport poids-volume d'un mélange granulé est plus élevé que celui d'un mélange libre. Lors d'une fusion en pots, deux enfournements sont suffisants au lieu de trois. Le laps de temps qui s'écoule jusqu'à la fusion complète peut être réduit de 25 % dans le cas d'une fusion de cristal contenant 30 % de plomb.

Un nouveau procédé, pour lequel un brevet a été demandé et qui permet la production continue de granulés pratiquement exempts d'eau, a été mis au point. Le procédé exclut toute addition d'agent de liaison qui peut influencer la composition du verre et amener des inconvénients lors de la fusion ou de la décoloration. Il fournit directement des granulés secs et élimine donc le problème du ramollissement des granulés par séchage normal.

Le procédé a été utilisé dans la pratique et a donné d'excellents résultats pour des mélanges dont le rapport potasse/soude était égal ou supérieur à 1.

Verfahren zur Pelletisierung von Blei- und Kaliglasgemengen

Die Pelletisierung des Gemenges hat im Vergleich mit losem Gemenge viele Vorteile: Während der Handhabung und Beschickung werden Entmischung und Verstaubung verhindert. Mögliche Gesundheitsschäden durch Bleioxid und andere Komponenten beim Einlegen werden reduziert, die Ofenkorrosion wird vermindert. Bei der Bleiglasschmelze werden die Bleiverluste reduziert und die Homogenität der Schmelze verbessert. Das pelletisierte Gemenge hat sehr gute Fließeigenschaften, die das Einlegen von Hand erleichtern und auch das maschinelle Einlegen ohne komplizierte Vorrichtungen ermöglichen. Pelletisiertes Gemenge hat eine höhere Dichte, weshalb bei der Hafenschmelze nur zwei Einlagen anstatt drei erforderlich sind. Bei der Schmelze von 30 % Bleikristall kann die Zeit für die Rauhschmelze um 25 % verkürzt werden.

Es wurde ein neues, zum Patent angemeldetes Verfahren zur kontinuierlichen Herstellung praktisch wasserfreier Pellets entwickelt. Es arbeitet ohne Zusatz eines Bindemittels, das die Glaszusammensetzung beeinflussen oder Schmelz- bzw. Farbstörungen hervorrufen könnte. Es werden sofort trockene Pellets erzeugt, womit das Problem der Trocknung durch Wärmebehandlung umgangen wurde.

Das Verfahren wurde praktisch erprobt, es hat sich bei Gemengen mit einem Pottasche/Sodaverhältnis von 1:1 oder größer sehr gut bewährt.

The use of an ordinary loose glass batch has the disadvantages of dusting and segregation during handling and transport and carry over in the furnaces. By manual charging of lead glass batches into pot furnaces the poisoning hazard from red lead dust and fumes is a serious problem. During the last years such a high lead content has been found in the bodies of some of the furnace workers, that they had to change to another job.

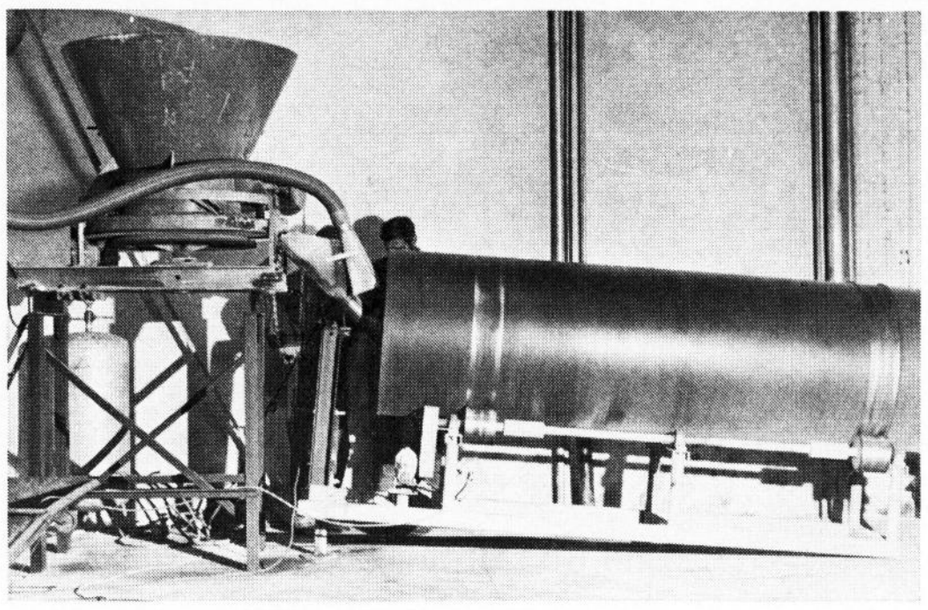

Figure 1. Left: Equipment for charging batch to the barrel.
Right: Upper part of the pelletizing barrel.

1. Compacted batch

The disadvantages mentioned could to a large extent be avoided if compacted batch is used. Such compaction could be achieved by briquetting, by pressing between steel rollers or by pelletizing of the batch. To produce briquettes, rather expensive machinery is needed, pressing between rollers cause very strong wear on the rollers. Pelletizing therefore seems to be the best method.

The formation of granular aggregations or pellets during the pelletizing takes place by imparting a rotary movement to the batch during simultaneous injection of finely divided liquid, normaly a solution of a binding agent such as sodium silicate in water.

2. Compaction by pelletizing

2.1. Problems

There are some practical problems which have to be solved by pelletizing a glass batch and keeping costs down.

If the binding agent contains components going into the glass such as sodium silicate or sodium hydroxide, the addition must be very carefully controlled in order to keep the glass composition constant. Organic binders may give discolouration or melting troubles. The necessary amount of water may vary but sometimes up to 25% has to be added. The drying of the pellets requires special equipment and heat consumption.

Most glass batch pellets undergo a phase during drying when the watersoluble components such as soda ash, potash, borax, etc. "wet" the pellets under the influence of increased temperature and increased solubility.

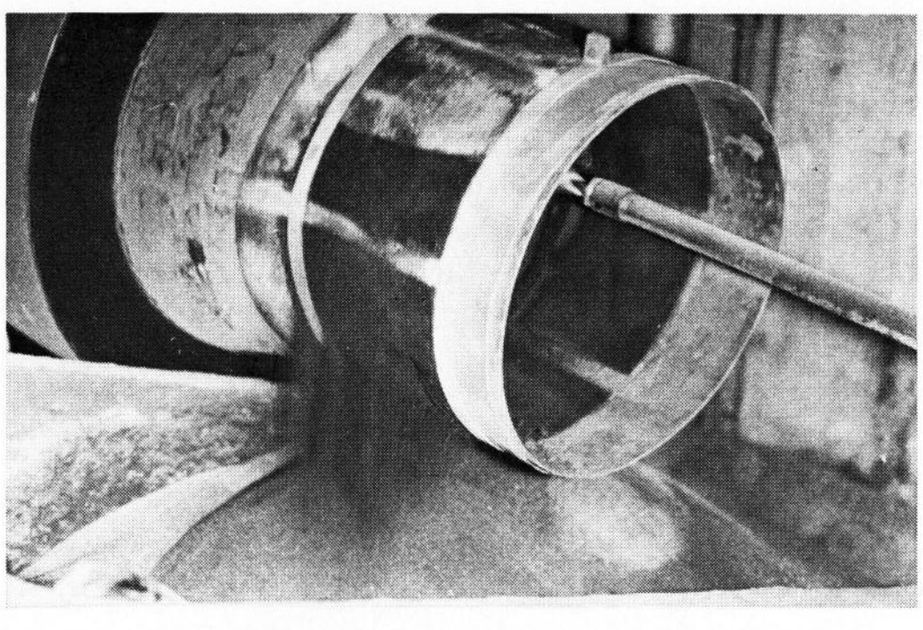

Figure 2. Lower part of the barrel where the pellets are discharged. In this case the diameters of pellets are 1 to 3 mm.

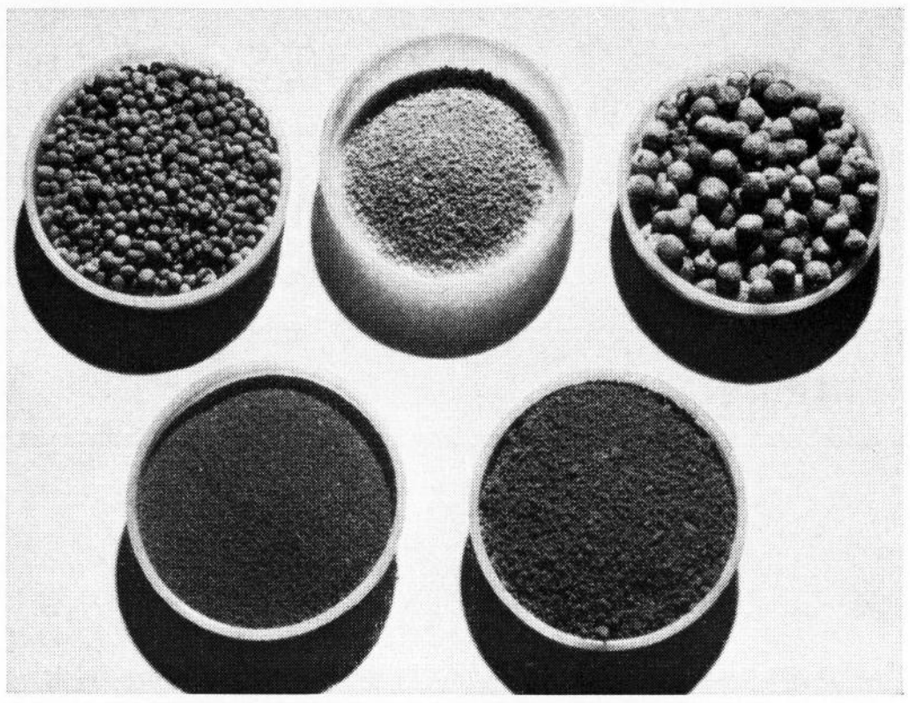

Figure 3. Samples of pellets of various sizes produced by the process described in Swedish Patent No. 340862.

This reduces the strength of the pellets so that they are destroyed when exposed to a minimum of mechanical actions or they soften and stick together.

2.2. Process for pelletization and results

The problems mentioned are to a large extent eliminated in the process developed by the Glass Research Institute at Växjö, Sweden, and described in the Swedish Patent No. 340862 and corresponding foreign patents.

This process has up to now been successfully used for batches in which 50% or more of the alkali content consists of hydrated potash ($K_2CO_3 \cdot 1^1/_2\, H_2O$). In this process the pelletization is carried out at a temperature between 100 and 600 °C, and water without any binding agent is injected and transformed into steam. This makes it possible to use comparably small amounts of water and the water added could be removed during the same process without passing a "soft" stage. By increasing temperature by normal drying of pellets, some of the potash or soda ash dissolves in its own crystal water and excess water added and the pellets become soft. Yet, if the temperature is high enough, the alkali components can not take up crystal water, the amount of water which has to be added is reduced and the problem with reduced strength and sticking is practically eliminated.

One device used to carry out the process is shown in figures 1 and 2. The main part is a rotary drum or barrel, inclined some degrees to the horizontal plane. The batch, which in this case is premixed, enters in the upper end into a mixing and pelletizing zone, where the water is supplied and transformed into steam. Heat is supplied to the barrel through gas burners at the lower end where the dry pellets are discharged. In the experimental equipment described here, the length of the barrel was about 3 m and the inner diameter about 0,6 m.

The size of the pellets is determined by the inclination of the barrel, the rotation speed and the amount of water and heat added. Pellets between 1 and 15 mm diameter have been produced. For the charging and melting of 30% lead glass batches and crystalline glass batches, pellets between 2 and 4 mm have given the best results. They have excellent fluidity properties, useful by mechanical charging and also good melting properties. Some samples of pellets are shown in figure 3.

As an example of results, the following figures could be mentioned:

— composition: 30% PbO lead crystal batch, K_2O as $K_2CO_3 \cdot 1^1/_2\ H_2O$;
— capacity: ≈ 500 kg/h;
— heat consumption: 1,2 kg propan/h;
— water added: ≈ 8 l H_2O/h;
— size of pellets: 1 to 3 mm diameter;
— water content of pellets: (loss of weight at 300 °C) ≈ 2%.

By charging these pellets by hand, practically no dusting or fuming could be seen.

The time to obtain "batch free melt" was decreased by about 20% which means an energy saving of about 8% in the actual furnace. The size of the pots were h = 65 cm and diameter 90 cm. The general impression after some weeks of melting pelletized batch was that the homogeneity of the glass was improved, compared to loose batch melting. No complains about glass defects or colour were given.

The same tendency was found with a potash glass batch ("crystallin" containing about 4% of PbO).

By standardization of glass compositions, centralized batch mixing and pelletizing for groups of smaller glass works could be interesting. The number of workers could be reduced, better control of the quality of the batches would be easy to obtain and the pelletized batch does not segregate during transport. 73R0268