Critical review report for the Comparative Life Cycle Assessment “Full-Face Surface Conditioning of Steel Slabs - Scarfing to Grinding”

LCA performed by
Saint-Gobain Abrasives

14/05/2024

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1 Introduction

Saint-Gobain Abrasives ("the practitioner") performed a comparative Life Cycle Assessment (LCA) of techniques for the full-broad-face, both sides, surface conditioning of steel slabs. The aim of the study was "to objectively establish, understand, and compare the environmental impacts of both Scarfing and Grinding Full Face Surface Conditioning operations".

The practitioner first wanted to have a critical review of the LCA performed by an external expert in order to check its compliance with the ISO standards 14040 and 14044. Gingko 21 reviewed the first version of the report once the study was completed. As the practitioner wanted to be able to use the results to eventually publicly communicate comparative assertions between different systems, a critical review by a panel of interested parties was then carried out.

The present critical review report was prepared by the critical review committee and is intended to be added to the LCA report.

The details of the points discussed during the critical review are presented in Appendix A.

2 Reviewers

The critical review was performed by:

- Hélène Teulon, LCA expert, founder of the Gingko 21 company specialised in LCA and ecodesign,
- François Privat, LCA expert within Gingko 21,
- Jean-Pierre Birat, expert in LCA and steelmaking processes, senior consultant (IF Steelman),
- Jean-Paul Selleron, expert in abrasives and grinding applications, senior consultant (JPS Consulting).

Gingko 21 acted as external expert for the first iteration of the review process, and then as chair of the critical review committee.

3 Goals and scope of the critical review

The aim of the critical review is to validate the compliance of the LCA report to the requirements of the following standards:

- ISO 14040:2006 - Environmental management - Life cycle assessment - Principles and framework;
- ISO 14044:2006 - Environmental management - Life cycle assessment - Requirements and guidelines.

The main elements to be validated during the critical review process according to ISO 14040-44:2006 are the following:

- The methodology used to carry out the LCA must comply with this standard;
- The methodology used to carry out the LCA must be scientifically and technically valid;
- The data used must be appropriate and representative of the objective and scope of the study;
- Interpretation must reflect the identified limitations and objectives of the study.

This critical review includes:

- A validation of the methodology used in the LCA and a check of the compliance of the study with ISO standards 14040 and 14044;
- A check of the consistency of the report, especially the consistency between the results of the calculations and the conclusions of the study;
- The review of the readability and the transparency of the report;
- The review of the input data;
- The review of the order of magnitude for a few calculations.

The critical review does not cover the systematic review of the calculations. Their accuracy is the responsibility of the authors of the study.

4 Critical review process

April 5, 2023	Videoconference with the practitioner and Gingko 21: kick-off of the critical review by an external expert
April 12, 2023	First version of the LCA report received by Gingko 21, from the practitioner
May 3, 2023	First version of the grid of critical review comments sent by Gingko 21 to the practitioner
May 12, 2023	Videoconference with the practitioner and Gingko 21: discussion about the first comments from the critical review
June to November 2023	Search for technical experts in steelmaking and abrasion processes to constitute the critical review committee
December 20, 2023	Videoconference with the practitioner and the critical review committee: kick-off of the critical review by a panel of interested parties
December 20, 2023	Second version of the LCA report sent by the practitioner
January 23, 2024	Second version of the grid of critical review comments compiled by Gingko 21 and sent to the practitioner (including Gingko 21's answers to the practitioner's answers to the first comments, comments from the "technical experts" Jean-Pierre Birat and Jean-Paul Selleron to Gingko 21's comments and to the practitioner's answers, and new comments from the technical experts)
January 24, 2024	Videoconference with the practitioner and the critical review committee: discussion about the second version of the grid of comments from the critical review committee
February 27, 2024	Third version of the LCA report sent by the practitioner
April 2, 2024	Third version of the grid of critical review comments compiled by Gingko 21 and sent to the practitioner
April 2, 2024	Videoconference with the practitioner and the critical review committee: discussion about the third version of the grid of comments from the critical review committee
April 4, 2024	Last version of the LCA report sent by the practitioner
April 24, 2024	Final critical review report sent by Gingko 21 to the practitioner, after approval by the critical review panel

The critical review by an external expert begun at the end of the study, in April 2023. One draft report version was sent by the practitioner and commented by Gingko 21. The critical review process then evolved into a critical review by a panel of interested parties, which started in December 2023. Two draft report versions were sent by the practitioner and commented by the critical review committee, before the final version. Several meetings were organised in order for the critical review experts to explain some of their comments/questions and for the practitioner to explain some of his answers. The practitioner sent the final version of the report on the 4th of April 2024.

The collaborative and fruitful critical review process improved the quality of the final report and enhanced the credibility of the study's conclusions. In particular, the following points were discussed and led to the improvement of the report.

First, the type of critical review is now consistent with the objective of communicating comparative assertions, in compliance with ISO 14040-14044. Shifting from a critical review by an external expert to a critical review by a panel of interested parties allowed to significantly strengthen the expertise of the critical review committee in the scientific disciplines relevant to the study, which in turn allowed to improve the overall quality of the study.

Second, the goal of the study is now more clearly stated. It is notably explicit now that the study was carried out to establish an objective comparison between grinding and scarfing, but conservative choices (unfavourable to grinding) were made when hypotheses were uncertain.

Third, the scope of the study was also improved, with regard to both the functional unit and the definition of the boundaries of the systems under study.

The functional unit is more robust and it better reflects that grinding and scarfing do not allow the same precision on the thickness of material removed. More details are also given on the grinding operations under study, namely the flow rates in kg/m^3 and the geometric characteristics of the grinding wheels.

The LCA studies and compares the following systems: two grinding configurations (which differentiate themselves by machines and wheels used), and two scarfing configurations (manual and machine scarfing). The boundaries of these systems now include the production of the removed material, the surface conditioning operations themselves and the residue valorisation. The production of the removed material was not included in the first draft version of the report and was added as a result of the critical review, which allows for a fair comparison between grinding and scarfing. Indeed, as both techniques do not allow the same precision on the thickness of material removed, different quantities of material removed shall be considered when a particular thickness is targeted (3 mm here). Besides, results for the different life cycle stages are reported separately to avoid summing up the direct impacts of the surface conditioning operations with the upstream and downstream impacts, which are more variable and uncertain.

Among the improvements, more residue valorisation scenarios are now evaluated, considering extreme avoided-impact hypotheses. Steel chips from grinding are thereby considered to substitute either primary steel or external scrap, and scale from scarfing is considered to substitute either iron ore or external secondary iron.

Fourth, the representativeness of certain assumptions was improved. Examples include:

- Emissions from the combustion of the phenolic resin of the wheels were refined;
- The recovery rate of steel chips from grinding was refined;
- Impacts linked to the incorporation of the inert part of the wheels to the process of chips valorisation were estimated and added;
- The iron content in scale from scarfing was refined.

Fifth, the compliance of the conclusions with the above-mentioned standards was also improved. Significance thresholds for the different impact indicators assessed were added before the presentation of results. The section describing the limitations of the study was expanded. The conclusions were further contextualised, recalling the concerned scope and the relevant limitations. Recommendations and perspectives were added at the end of the report.

Sixth and last, the coherence and the comprehensibility of the report were improved (structure, wording, quality of figures and graphics).

A comprehensive work was done during the critical review process by Saint-Gobain Abrasives to integrate improvements as suggested by the critical review committee, specifically about the life cycle boundaries, the methodological choices around the valorisation of residues, and the justification of the assumptions. All comments and limits noted by the committee were thoroughly addressed.

5 Critical review conclusions

This report is delivered by the critical review committee to Saint-Gobain Abrasives. The critical review committee cannot be considered responsible for the use of its work by third parties. The conclusions cover all the elements presented by Saint-Gobain Abrasives, as mentioned above, and no other reports, extracts, publications, or generalisations of any kind that could be made. The conclusions were given in the context of the current state of the art, and the information received during the critical review work. These conclusions might have been different in a different context.

The study meets the requirements and recommendations of ISO standards 14040 and 14044:

- The report is clear, comprehensive, and transparent;
- The scope and objectives of the study are clearly stated in the report;
- The calculation assumptions and methodological choices are transparent and well argued;
- The conclusions presented are consistent with the results of the calculations, they are moderate and take into account the limits of the study.

All foreground data are based on primary, overall robust data. The displayed results are credible.

The performed evaluations are in accordance with the state of the art in science and technology and are conducted in line with the objectives of the study. They are referenced and documented understandably.

Potential uncertainties, known limitations and sensitive assumptions are analysed and documented by sensitivity analysis. More precisely, in addition to the two variants evaluated for each surface conditioning technique, the following sensitivity analyses are performed:

- Removed layer thickness (3 mm for scarfing);
- Geography (influence of 12 alternative geographies on the electricity mix, the natural gas mix, and the impacts of oxygen production);
- Climate change characterisation method (verification of the stability of the conclusions with alternative characterisation methods).

The interpretation of results is neutral and detailed; the gained insights are understandably presented and are in accordance with the goal of the study. The evaluation, interpretation and conclusions are valid in the context of the study.

The report is transparent and consistent, its structure reflects the ISO standard. The reporting is in accordance with the objectives of the study, the final results of all impact categories are plausible and conclusive.

In view of the final LCA report, the critical review committee considers that the conclusions adequately and credibly meet the objectives mentioned, in the context mentioned and for the goal mentioned, and that they have been drawn up in accordance with the standards mentioned. These conclusions are in line with the limitations mentioned in the LCA report and with the elements provided in this critical review report. The final LCA report is thus in line with the general requirements of ISO 14044 concerning LCA reports communicated to third parties.

The final conclusions of the report have to be used in the strict scope of the study.